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VIEWS, NEWS AND INTERVIEWS.

"The storage battery is so firmly established and is proving day by day such a boon to the irregularly loaded power-station, that the fake and crank inventors have invaded the field," said a battery expert. "Only a few days ago an inventor called on me with drawings and models of a storage cell which would be worth millions—if it were only so. I asked him what special advantage he claimed for his cell over the one I sell.

"'Why,' he said, 'I get 100 volts for every pound of lead in my cell.'

"'Indeed!' said I, 'my cell does the same thing.'

"'Yes, I know,' he replied, 'but my cell gives very much larger volts than yours!'"

The Red Lion Inn, the famous hostelry at Stockbridge, Mass., has under contemplation the installation of an isolated electric plant to light the already large hotel and an addition now being built.

The largest pumping plant in England driven by electricity has recently been put to work at the Armston Colliery. The generating station contains two 350 horse-power engines, built by Messrs. Robey, of Lincoln, which drive the dynamos by means of rope belting. The engines are compound, having cylinders 16¾ inches and 26½ inches in diameter by three-foot stroke, fitted with Richardson & Rowlands's automatic expansion gear. The dynamos and other electric plant have been supplied by Messrs. Scott & Mountain, of the Close Works, Newcastle-on Tyne.

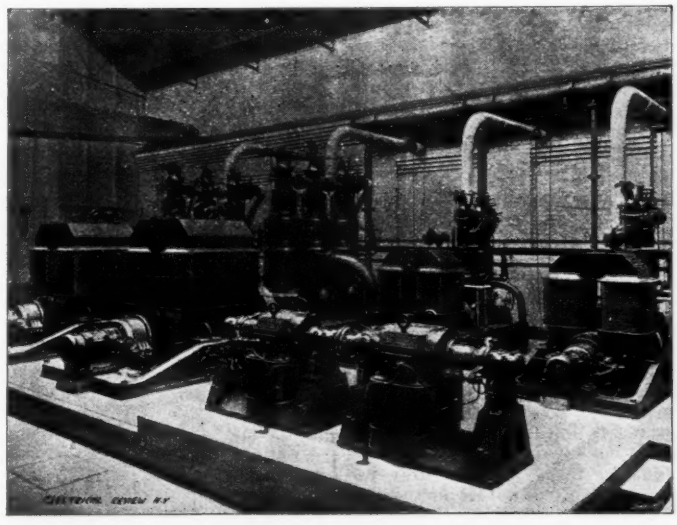
Chief Engineer Gardiner C. Sims, of the U. S. repair ship "Vulcan," writes that he is in the best of health and spirits. The temperature of the "Vulcan's" engine-room is 110 degrees and that of the fire-room is 135 degrees.

A new power-house is to be built on the Rhone at Geneva, Switzerland, and will be largely equipped with apparatus manufactured by Brown, Boveri & Company. This power-house will take the place of one recently destroyed by a fire which started in the transformer-room of the plant.

R. E. Sherman, a Chicago electrical engineer and inventor, expects to have, at the Paris Exposition of 1900, a giant "umbrella." The idea of it is to carry passengers to a great height overlooking the exposition grounds. The plans call for a steel structure 350 feet high and 250 feet in diameter from car to car, when the cars are at the top. Ten cars are planned, each capable of accommodating fifty passengers. Mr. Sherman says that the cars can make three trips every hour, which will admit of their carrying more passengers in that time than the Ferris wheel did, because all the cars can be loaded at one trip. The cars are to be supported at the ends of 10 long steel cables, which are to run over the ends of the arms or staves of the "umbrella." The power is to be applied from the platform around the central column. The platform is intended to move up and down the column and to carry 350 passengers. The power by which it is expected to move the platform, and so lower and raise the cars, is hydraulic pressure. Another motion is also provided for in the plans. That is a rotary motion of the platform, carrying with it the cars, and that motion is to be carried out by a separate application of electrical power.

To prevent the engines of a vessel from "racing" when the screw rises above the water, Signor E. Putalo has invented an electrical regulator. The contrivance, according to a London contemporary, consists of two vessels of mercury, connected at the bottom by a tube and mounted fore and aft in the ship. The vessels are about half full at normal depth. When the ship pushes forward so as to raise the screw, the rods connected with the resistance are submerged one after the other, so that an electro-magnet is brought into play, the whole resistance being short-circuited when the screw is entirely out of the water. The electro-magnet operates a throttle valve in the main steam-pipe, which is thrown open by another magnet. By this arrangement the steam is turned off and on. From experiments it has been shown that the mercury vessels need not be more than 34 inches apart on a ship 300 feet long.

The grand jury is said to be investigating many of the alleged "crooked" damage suits brought against the various street railway companies in New York city.



GENERAL VIEW OF ENGINE-ROOM AT THE HULL, ENGLAND, NEW CENTRAL STATION, WITH MOTOR-GENERATOR IN FOREGROUND.

The New Central Station at Hull, England.

A new generating station has been recently put in service in the old city of Hull, Eng. The London technical journals, in recent issues, have described this plant, and the following facts in regard to it are taken from our British contemporaries.

The plant was constructed and designed to supply current to the territory outside the center of the city, to which current was furnished by an older station. The new territory, being a wide and scattered area, is supplied with a standard pressure of 220 volts. The mains are fed from substations and also from low-tension dynamos at the new generating station.

The plant consists of two high bays forming the engine-room and boiler-house, with a block of offices, pump and accumulator-rooms. The engine-room is well lighted from the roof and is lined with light buff brick with a white glazed brick dado. Installed at the present time are four Willans engines, two being coupled to low-tension Parker dynamos, and two of a larger size connected to continuous-current, high-tension Parker dynamos.

The boiler-house now contains three boilers, two Lancashire and one Babcock & Wilcox water-tube. The feed pumps are worked by steam, but the centrifugal pumps for the condensers are driven by electric motors.

There are two storage batteries, one of 120 cells at the generating station and one of 240 cells at a substation. This substation is installed in four arches under the approach to a railway bridge. One arch contains four transformers with a switchboard, with space for two more shortly to be installed. Another arch contains the storage battery and the remaining two are devoted to cable stores and meter testing. The other substation is a specially built brick building with a flat concrete roof. In it are two transformers, a switchboard and a balancing motor generator. The view of the interior of the engine-room presented herewith is taken from our London namesake.

THE STATUS OF ELECTRICAL INVENTION.

ABSTRACT OF AN ADDRESS READ BEFORE THE FRANKLIN INSTITUTE, PHILADELPHIA, NOVEMBER 8, 1898, BY WILLIAM A. ROSENBAUM.

Since the beginning of this epoch, so rapid and effective has been the progress of electrical invention, that each branch of the science, from the moment of its inception, has been developed to a state closely approaching perfection, within a few years.

Notwithstanding the fact that the United States Patent Office is now issuing about 25 patents per week relating to electricity, it is noticeable that there are but few controlling inventions among them. Indeed, in the fields of telegraphy, telephony, electric lighting, electric railroading, chemical and mechanical generation and the storage of electrical energy, it is difficult to point to more than two or three controlling inventions of so recent origin as to be within the last five years. And when we parallel this with the statistics showing the stupendous extent to which it has been possible for these subjects to interest capital, if we were not progressive, we might be prompted to believe that these branches of the science, at least, have been perfected.

The production of the commercial underground trolley furnishes an apt illustration of how invention in any art may come to a standstill and even have its "rise and fall." Following the proposition to put the overhead trolley under ground came an avalanche of invention showing how not to do it.

Systems without number came out involving sections, sub-sections, relays, cutouts, switches, sparkless contacts, methods of insulation, and so forth, the general object being to avoid leakage and render the line safe to persons and animals. But the futility of all this effort was suddenly demonstrated by the operation of one or two sub-trolley roads whose electrical construction was practically the same as that of the overhead system, to-wit: A bare live conductor supported upon insulators. In consequence, the avalanche of invention soon flattened out and gave way to the earliest and simplest ideas.

Naturally, the arts have been developed more rapidly in modern times than formerly. While the telegraph, which originated in 1840, required about 40 years, the telephone, which originated in 1876, only required about 15 years in its development, and while it may be urged that telephony has not reached the same state of development as telegraphy, yet I think it only lacks a serviceable repeater to have acquired the same distinction. Likewise, the dynamo-electric machine which resulted from Faraday's experiment of 1831, and its converse, the electric motor, were of but little real value until half a century later, when the progress made in the theoretical treatment of magnetic problems made it possible to predict the electrical and mechanical output under given conditions of speed and load. Contrary to this, the two branches of the science, electric lighting and electric railroading, the two industries made possible by the dynamo and electric motor, were developed, the former to a standstill, within 15 years, and the latter within a decade.

Up to 25 years ago the simple Morse system of telegraphy was the only one in general use. Experiments had been made with printing and chemical automatic systems, and although the duplex system was in limited use, it had not been perfected. As to the beginning of the art, the needle telegraph of England, I believe, has the precedence, but this was very shortly followed in 1840 by the more practical system of Henry and Morse, the electro-magnet of which is the responding element of the American telegraph system to the present day.

The key is one of the most important instruments of the system. A vast number of patents have been taken on it, the object of invention having been primarily to transform the old, heavy, cumbersome mass of brass introduced by Morse into the light "solid lever" keys used in this country at the present time, and of which the "Bunnell" key is the pioneer.

The relay, another important instrument, has undergone many changes in shape, dimensions and resistance since it was first invented. In weight alone it has changed from about 300 pounds to three pounds. But improvements of both this instrument and the sounder have been more the work of the designer than that of the inventor. The Morse register, which was formerly in use as the receiver, has been superseded by the present method of receiving by sound.

The great inventions in telephony were made within the five or six years following the time when Alexander Graham Bell proved telephony to be a practical thing. The Centennial Exposition of 1876 was fortunate in at least two things: First, that it was held in Philadelphia; and second, that it made the first public exhibition in the United States of the articulating telephone.

The principle underlying the operation of the telephone, since its inception and to the present day, is best stated in that famous fifth claim of the fundamental Bell patent of 1876, to-wit:

"The method of * * * transmitting vocal or other sounds telegraphically, * * * by causing electrical undulations, similar in form to the vibrations of the air accompanying the said vocal or other sounds * * *."

The multitude of devices that have been invented for transforming these air vibrations into "electrical undulations" may be divided into two classes: Those in which a magnetic field of force is varied, and those in which the nature of mechanical contact between a plurality of conducting bodies is varied.

The introduction of the telephone to commercial uses necessitated the supply of various auxiliary devices for calling and interconnecting purposes, and the several thousand patents issued in the art attest to the vast amount of invention that has been necessary to bring the art to its present degree of perfection. Brief reference to the most important of these will follow.

First of all came the Bell instrument, used both as transmitter and receiver, and as in use to-day as a receiver only, is practically of the same construction as the original instrument, consisting merely of a magnet facing up a flexible disk forming or carrying the armature.

Following this very shortly came the michrophone or carbon transmitter, in which the movements of a diaphragm varied the pressure upon a body of carbon forming a part of the circuit. This instrument had many modifications involving carbon buttons, carbon pencils, balls and carbon powder, but no substantial changes have been made in late years.

The induction coil was the next important piece of apparatus. This made its appearance in 1877, and by virtue of it, it became possible to telephone to considerable distances with an initial current of low electromotive force. This device still plays its important part in all extended systems. The induction coil and the microphone transmitter brought into use the voltaic battery in connection with telephony.

Various forms of calls have been invented and used, but the most acceptable, and one of the earliest, is the magneto call by which the user generates the calling current. Allied to this is the automatic switch (1879), the function of which is to cut the calling magnets into circuit when the receiver is hung upon its supporting hook and to remove it from the circuit when the receiver is put into use.

The fundamental inventions in electric lighting were practically all made prior in 1884, and what there is of interest subsequent to that time, to record, is mainly the work of the electrical engineer or skilled electro-mechanic.

Following the successful introduction of the series lamp came a demand for long-burning lamps. This was met at first, although not successfully, by changing the shape and dimensions of the carbon electrodes into plates, disks and various other forms affording more body, but the best form, and the one which enjoyed the most extended use, was the double-carbon lamp, in which the carbons were consumed in succession. For lamps burning on constant potential circuits, the most recent and almost universally adopted plan for long burning is the "enclosed-arc" lamp, capable of continuing in operation for 100 to 150 hours. This increased life of the carbons is due to the fact that the arc is enclosed in a chamber from which the atmosphere is excluded, combustion of the carbons being thereby retarded. Alternating-current lamps are in common use on constant-potential circuits, but their construction does not materially differ, inventively considered, from the continuous-current lamps. Focusing lamps wherein the arc is maintained at a fixed point in space are now in common use where it is desired to project a strong beam of light. The fixity of the arc is accomplished by feeding both carbons by mechanism operating on the same general plan as that of the series-connected lamps.

Taking up incandescent lighting at the beginning of its commercial existence, and bearing in mind that this paper is treating of "invention," we scarcely find anything of importance to note, beyond the production of the one form of lamp which has been in use since its origin, in 1879, and the system of distribution by which it is most economically operated.

The very first appearance of the electric railway in the history of the world is attributed to the little circular model, built by Thos. Davenport, a Green Mountain village blacksmith, in 1837. This model consisted of a car carrying a motor whose field magnet was fixed, and whose revolving armature was connected to the axle by bevel gear. The invention, like many others that followed it through the years 1850, 1855 and 1860, failed largely because of the lack of a suitable source of electricity. This pioneer railway, as well as those of Hall, Page and other early workers, derived its propelling current from primary batteries carried on the car. The advent of the successful dynamo electric generator marked the beginning of practical railway development. Among the pioneers who took advantage of this may be mentioned Geo. F. Greene and Stephen D. Field, who contemporaneously invented the plan of connecting the electro motor on the car with a stationary dynamo by means of conductors. This occurred just prior to 1880.

In 1882 Jos. R. Finney exhibited an electric street car, an overhead wire, a trolley fitted with grooved wheels running on this wire as a track, and connected with the car by a flexible conducting cord. The year 1884 marks the first instance of an electric car in regular operation on a street railway track in the United States, as also the reduction to practice of the conduit system wherein the conductors are mounted upon insulators in a conduit, and connection made therewith by means of a plow extending through the slot in the conduit.

The invention of the car controller on a vehicle receiving its propelling current from a stationary source is credited, by some, to Greene. The invention of the speed-controller by

commutating the field of the motor or motors, and the controlling box for accomplishing this, is another important invention in the art, and while the carbon brush is used on many other machines besides on traction motors, it may be mentioned here as one of the important factors in railway development.

Still another important invention is the Sprague method of mounting the motor on spring supports, to protect the gearing and allow for slight changes of relative position of the armature shaft and axle.

One of the most important developments in the electric railway—and, indeed, about the last—was the slow-speed motor, the production of which, although due largely to the skill of the designer, was the subject of an invention originally. No practical machine of this sort appeared until the Summer of 1890, when the Wenstrom company, of Baltimore, brought out a very efficient and well designed motor that possessed this valuable property of slow speed. This machine was also among the pioneers in the so-called "ironclad" type, where the magnetic circuit completely shuts in the armature and field-coils. The speed of this machine was about 400 revolutions per minute, which permitted of its armature being geared directly to the car axle without the intermediate counter-shaft that had been the subject of frequent objurations from every electrical man who had been in the business long enough to have gearing give out.

H. B. Coho & Company's Creditors Meet.

H. B. Coho & Company, dealers in electrical apparatus and supplies, formerly at No. 30 Cortlandt street, New York city, called a meeting of their creditors, which was held on November 18 at No. 143 Liberty street, about 75 per cent of their creditors being present. The liabilities are $60,000, while the assets are estimated at $40,000. A committee of five creditors was appointed to collect outstanding accounts and divide the proceeds pro rata among the creditors. The committee consists of representatives of the Eddy Manufacturing Company, the Oswego Boiler Works, the Marietta Manufacturing Company, the City Bank of Hartford, and the Harrisburg Foundry and Machine Works. The business was started in 1884 by Herbert B. Coho, and the "Company" was George C. Hoffman. Mr. Coho has obtained an injunction restraining Mr. Hoffman from disposing of the property of the firm, collecting any money or compromising any claim due the firm.

Mr. Edison has denied the report that he was about to make a visit to St. Petersburg, Russia.

The Wright Discount Meter.

The Wright discount meter, manufactured by the Wright Discount Meter Company, Chicago, is a maximum recording ampere meter for either direct or alternating currents, and records the maximum amperes that have passed through it at any one time since it was last set. It is purposely made slow-acting, for the reason that any portion of the plant of an electric company will stand a very large overload for a minute or two and a less overload for a longer time. The meter is therefore so designed that, if the maximum load

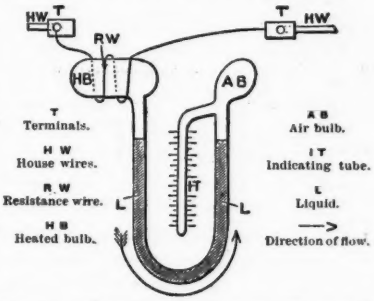


FIG. 1.—WORKING PARTS OF THE WRIGHT DISCOUNT METER.

lasts only five minutes, the meter will register about 80 per cent; if 10 minutes, 95 per cent; and the full 100 per cent when the load has continued half an hour.

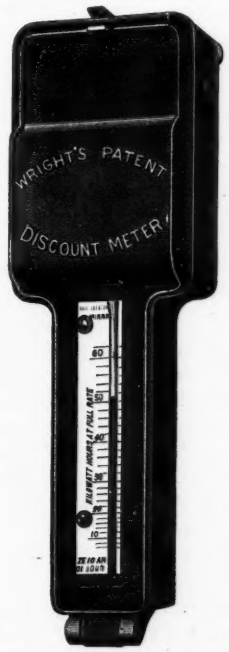


FIG. 2.—EXTERIOR VIEW OF THE WRIGHT DISCOUNT METER.

Figure 1 shows the working parts in principle. A liquid is hermetically sealed in a glass bulb, around which the wires or heating strip pass as shown. The passage of the current heats the air in the left-hand bulb and the expansion of the air forces the liquid into the right-hand bulb and indicating tube. The liquid when once spilled over into the indicating tube can not return until the meter is reset.

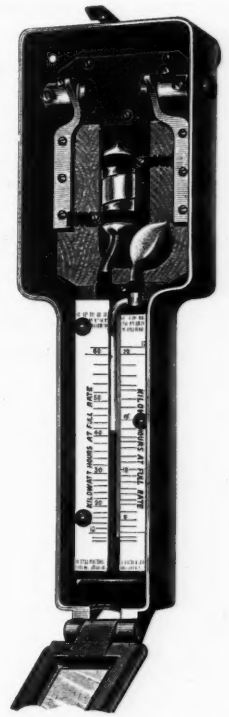


FIG. 3.—INTERIOR VIEW OF THE WRIGHT DISCOUNT METER.

Figures 2 and 3 are respectively exterior and interior views of the actual meter. The working parts are enclosed in an iron case (which can be securely sealed against tampering), fitted with a glass front, so that the meter can be read without having to open the hinged door. The case is so constructed that the meter can be placed in any locality without the slightest danger of damage, and as the only moving part is the liquid, which is hermetically sealed in the tube, it is practically impossible for the meter to get out of order.

Referring to Figs. 3 and 4, it will be seen that the glass tube is carried on a substantial backing, which is so hinged that the meter can be reset by tipping up the tube (see Fig. 4) and allowing the liquid to run back out of the indicating tube into the side tubes.

The Wright meter is connected in series with the recording wattmeter, or chemical meter, and registers in amperes the maximum demand on the station at any one time.

In order to facilitate the reading of the meter and the determination of the customer's bill, the Wright discount meter scale may be so calibrated that on one side it will read in amperes, and on the other directly in watt-hours, without any calculation, the amount of electricity to be paid for monthly at the full rate.

To arrive at the amount of electricity to be paid for at the low rate, subtract the watt-hours as shown by the reading of the Wright discount meter, from the watt-hours as shown by the recording wattmeter or chemical meter, according to the type of meter used, and the difference between these two readings will represent the watt-hours to be charged for at the low rate.

American Society of Mechanical Engineers.

The nineteenth annual meeting of the American Society of Mechanical Engineers will be held in the society's parlors, 12 West Thirty-first street, New York city, from November 29 to December 2, inclusive. The programme includes a large number of interesting papers on mechanical subjects.

Mr. A. M. Young, at a recent meeting of the board of directors of the Kings County Electric Light and Power Company, of Brooklyn, N. Y.,

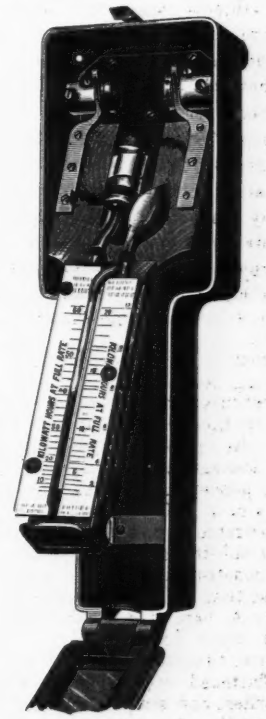


FIG. 4.—SHOWING METHOD OF RESETTING THE WRIGHT DISCOUNT METER.

was delegated by resolution to rearrange the entire electric lighting system of Brooklyn, as comprised in the four companies now united under the above name.

BOTTLED VOLTS.

LATEST MEDICAL DISCOVERY.

Our patent medicine editor has had a visit from a vendor offering a small bottle of Dr. ———'s "Great Electric Jar. The Only Catarrh and Headache Cure," accompanying the offer with the statement that the little vial (five-eighths inch by two and one-eighth inches) contained 100 volts, nicely packed and ready for withdrawal in quantities to suit. "All you have to do," said the vendor (we almost said fakir), "is to uncap the vial, place it to your mouth and inhale a few volts. You will find soon that the volts get in your eyes and make them water, and, presto, your catarrh is a thing of the past."

That sounded well, and we had to invest to get at the true inwardness of this bottle of concentrated thunderbolts. Upon testing, by unscrewing and smelling, we experienced a sudden rise of potential, going straight up the nasal passages, filling both eyes with volts *ad lib.* (perhaps *ultra lib.* would be better). "Volts by the hundred," said the vendor. Volts by the million say we; but the most peculiar end-of-the-century volts they were. One could not feel them crowding out of their glass-framed dungeon, couldn't catch them on the tongue like the old-time telegrapher, couldn't see them, couldn't observe their presence even with the aid of a reflecting galvanometer, but, jumping frogs, they were there even as the sands of the desert. They came out by the trillion and went straight up the nose of the observer; fat volts, thin volts, square, round and three-cornered, twisted and laminated, every variety of volts known and unknown to the scientific world. Tears? They would bring tears out of the eyes of a potato, or cure a cold in a head of cabbage.

But where was the generator? Ah! a glance at the vial showed a wicked looking brass wire gauze, bound in electric circuits of copper wire. Here was the prison of the volts, and it is no wonder they vamoosed when they got the chance. At the bottom of the vial was a small patch of a gummy substance containing the life-work of some fiend who had a grudge against the discoverers of asafetida, carbon disulphid, hydrogen sulphid, and other abominable malodorous compounds.

After our tear-ducts got shut off, a closer inspection and a few cautious whiffs, like testing butter among the hucksters, the bottle disclosed a very ingenious swindle. It was merely a tin-topped vial, containing a little wire-bound roll of brass gauze, with a dab of some gummy substance at the bottom, which evidently was impregnated with oil of mustard, one of the most potent of volatile substances for pungency and odor. Any considerable exposure to it will produce inflammation of the eyes and damage them.

But the volts are in the bottle, the very hottest kind of volts—mustard volts, if you please—but volts which attack till one's very eyes re volt. Let our readers be on the look-out for this fakir—especially our city readers.

ELECTRIC RAILWAY NOTES.

The entire system of street railway in Havana—25 miles of track—has been sold, it is said, to an English stock company for $1,600,000. The entire line will be rebuilt and the motive power changed to electricity.

The report of the Troy, N. Y., City Railway Company for the quarter ended September 30 last shows:

	1897.	1898.
Gross earnings	$142,174	$147,227
Operating expenses	66,338	74,437
Net from operation	75,836	72,789
Other income	1,681	1,905
Gross income	77,518	74,695
Fixed charges	35,497	35,218
Net income	42,020	39,477

The Pittsburgh Traction Company is suing H. Sellers McKee and others, alleging that in the reconstruction and equipment of the road with electricity $1,700,000 was paid for work for which $100,000 is said to have been a fair price. The court is asked for a decree ordering an accounting.

The Amherst & Sunderland, Mass., Street Railway Company at their annual meeting elected the following officers: Directors, W. D. Cowls, Levi Stockbridge, M. A. Dickinson, G. E. Fisher, H. B. Edwards, T. L. Paige and F. A. Cadwell; president, W. D. Cowls; vice-president, M. A. Dickinson; executive committee, W. D. Cowls, M. A. Dickinson and T. L. Paige; clerk, C. H. Edwards.

At the annual meeting of the stockholders of the Mount Holly, N. J., Street Railway Company the old board of directors and officers were re-elected, as follows: Directors, Amos Gibbs, John D. Johnson, Joseph Cross, Mark R. Sooy, Samuel H. Chambers, Robert S. Gaskill and Clarence H. Polhemus; Amos Gibbs, president; C. H. Polhemus, secretary and treasurer; Charles K. Chambers, superintendent. The report of the treasurer showed the profits for the year to be $21.12. During the year 25,315 passengers were carried.

ELECTRIC LIGHT FLASHES.

The electric light plant at Urbana, Ohio, heretofore owned by Chicago capital, has been purchased by a new company, of which Frank Chance is president and John C. Powers, secretary and treasurer.

The American Engineering Company, of Philadelphia, Pa., has been incorporated to equip and maintain electric light plants. The capital stock is $100,000. The corporators are Samuel B. Vrooman, Nathan Cox and John B. MacAfee, of Philadelphia, and John H. Tunstall, of Camden.

The Kalamazoo Valley Electric Company, recently organized, has begun the construction of a dam in the Kalamazoo River, four miles from Allegan, Mich., to cost $125,000, and which it is expected will develop 13,500 horse-power. Four large water-wheels will be put in, and the electric power generated will be distributed to Allegan, Kalamazoo, Plainwell, Otsego and other towns for lighting and power purposes. The plant will be in operation next Spring.

Thomas C. Barr, of Orange, N. J., and Col. A. R. Kuser, of Trenton, N. J., purchased last week the stock and franchises of the Trenton Electric Light and Power Company for $416,000. Messrs. Barr and Kuser represent themselves, President John F. Dreyden, of the Prudential Insurance Company, of Newark, and other capitalists. It is understood that their plans look to a consolidation of the electric light company with the Trenton Street Railway Company and the Delaware River Improvement Company. The Delaware River Improvement Company owns a water-power franchise at Merrisville, Pa., just across the river from Trenton, and is interested in the proposed damming of the Delaware river to supply the Trenton Electric Light Company and the street-railway company with power. The building of an electric railway to Philadelphia is also said to be one of the projects in view, and if accomplished will be an important link in the New York & Philadelphia Traction Company's line. The property sold for $416,000 represents a money investment of $170,000 made by the People's Electric Light Company. In 1892 Frank A. Magowan organized the Trenton Light and Power Company and absorbed the old company with a capital of $140,000. The stock was increased to $226,000 of preferred stock and $500,000 of common stock, with the payment into the new concern of but $30,000 additional capital.

LITERARY.

"ALTERNATING-CURRENT WIRING AND DISTRIBUTION." By William Le Roy Emmet. New York, 1898. The Electrical Engineer. Second edition, revised and extended; 4½ x 7 inches; 98 pages; cloth. Price, $1. Supplied by ELECTRICAL REVIEW.

Mr. Emmet's work is so well known and appreciated that it seems hardly necessary to revert to it again were it not for the fact that a second edition has now made its appearance. In this edition the author, while retaining all his useful explanations and methods for determining the proper methods of distribution, has added a large amount of useful information and hints bearing directly upon the question of proper wiring where an alternating-motor load is included in the system. It is to be noted that most central station managers have in the past, as it were, "reckoned without their host," and hence the hints and other useful information on motor load given in the new edition of Mr. Emmet's work will prove of special value. In fact, there is no case in alternating-current distribution, whether for local or for long-distance work, that Mr. Emmet does not treat of specifically and, one might say, work out by example, so that the book is adapted, as above stated, to all classes of alternating-current distribution work. An appendix on General Wiring Formulæ, with a very valuable table of wiring for 30, 65 and 125 cycles and for single-phase, two-phase and three-phase work, is added. We may safely say that no station manager can afford to be without this handy volume on his working desk.

Dinner to Mr. W. D. Weaver.

Mr. W. D. Weaver, editor of the *American Electrician*, of New York city, who served as chief engineer of the U. S. S. "Glacier" during the war, returned to his home in New York city last week. In honor of the event and as an expression of their esteem for him, Mr. Weaver was entertained at dinner at the Engineers' Club last Wednesday evening by a number of his friends, the most of whom were electrical newspaper men. The dinner was of an informal character and was a most enjoyable affair. Among those present were Dr. Louis Duncan and Messrs. Pope, Mailloux, Martin, Blake, Childs, Guy, Lowenthal, Bernard, McGhie, Hanchett and Coles.

The gross earnings of the Rome, N. Y., City Street Railway for the quarter ended September 30 last were $2,136.07; expenses, $1,839.96, showing a profit for the quarter of $295.11.

Measurements of Precision.

[*From Science.*]

An article in the *Physical Review*, September–October, 1898, by S. N. Taylor, should not be overlooked by those who are interested in knowing the degree of precision which may be reached in linear and other measurements.

The paper itself should be consulted, but a few of Mr. Taylor's most remarkable accomplishments may be mentioned here. It comes in his way to measure several diameters of a coil of wire, consisting of 15 layers, with 15 turns in each layer, the mean diameter of the coil being about 20 centimeters, and the wire being No. 18, copper, double-silk insulated, passing through a bath of hot paraffin during the process of winding.

It is wound upon a cup-shaped cylinder of plaster of paris, which was soaked in a mixture of linseed oil and liquid dryer sometime before its use. Mr. Taylor tabulates his measurements of these diameters, each layer, as it is wound on, in figures carried to thousandths and ten thousandths of a millimeter, thus implying that his measures are made to one part in two millions.

They are made, he says, by means of a cathetometer, before which the coil is mounted on an axis, that it may be turned into six different positions. Unfortunately, he does not say how far the coil was from the cathetometer or give the name of the maker of an instrument of a type so extraordinary as to justify these figures on the diameters of a wire coil. Still more unfortunately, he fails to give the results of several independent measurements in each position, which he says were taken.

A thousandth of a millimeter is always worth struggling for, and, as a variation of a single degree in the temperature of his cathetometer bar would probably change its length by 15 or 20 of them, it is to be inferred that highly perfected methods of determining that temperature were used, although the author is also silent on that point. The level on the cathetometer telescope must have been an uncommonly sensitive and well behaved attachment, the name of the maker of which should not be concealed. It can not be that these measurements are in any degree doubtful, for, otherwise, Mr. Taylor would hardly use them, as he has, in computing the constant of his instrument, in which operation he carries results to eight significant figures, the unit of the last place in his final mean standing for about one part in 30,000,000. A "sudden drop" is experienced, however, in the very next paragraph, where he says that the same calculation has been made by other people and by a different method, resulting in a quantity differing from the former by about one part in 500 or 600, and which he proceeds to use instead of the result of his own labors.

But it is not in linear measurement alone that marvelous skill is shown in this piece of work. There is weighing which must also excite admiration. A movable coil of the same wire, which must have weighed not much less than a kilogram, was suspended from the arm of a balance; and the "pull" on this coil, amounting, it is inferred from the tables, to about 23 grams in one case and about 45 grams in another, was weighed to within one tenth of a milligram. This, of itself, is not, perhaps, remarkable, but it becomes so when it is remembered that this coil is anchored to solid ground by two thin slips of "crimped" sheet copper, seven millimeters in width. The getting of a tenth of a milligram under such conditions implies rare skill. But the reader is again doomed to bitter disappointment when he is informed that the result of all this exquisite work is to give a value for the electro-motive force of a Clark cell, differing from all of the many good determinations that have been made before by more than one part in 250, or nearly one-half of one per cent, and that the author himself concludes that, as absolute measurements, his results "don't count."

"Figuratively speaking," Mr. Taylor's paper is, or ought to be, almost unique, but it is only justice to him to add that it really contains much that is interesting and valuable from points of view other than that of metrology.

A press dispatch from Philadelphia says that a deal to consolidate the three electric light plants in Baltimore—the Brush, Edison and Northern companies—is being arranged there. The Pennsylvania Manufacturing, Light and Power Company, which controls and operates the consolidated electric light and power plants in Philadelphia, does not appear in the deal. A banking house has secured options on the bonds and stocks of the Baltimore companies. The three concerns are capitalized jointly at $2,899,000, and their total issue of bonds amounts to $1,874,000. The plan is to deposit these securities in trust as security for an issue of $4,000,000 five-per-cent, 30-year collateral trust and mortgage bonds of the consolidated company, to be additionally secured by a mortgage on all the property and plants.

THE NERNST LAMP.

BY H. MONMOUTH SMITH, IN "SCIENCE."

The *Frankfurter Zeitung* contained recently a very interesting account of Professor Nernst's new electric lamp. As information on this subject has heretofore been so difficult to obtain, a brief abstract from this article may be of interest to the readers of *Science*.

As has been previously announced,

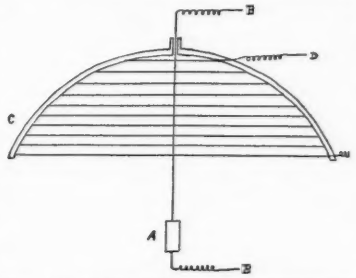


FIG. 1.—DIAGRAMMATIC REPRESENTATION OF THE NERNST LAMP.

Professor Nernst employs magnesium oxide for the illuminating material, which at ordinary temperatures is a non-conductor, but when heated to a sufficiently high degree (and herein lies Professor Nernst's discovery) becomes a perfect conductor and emits a brilliant white light. The preliminary heating of the magnesia A Professor Nernst accomplishes by placing

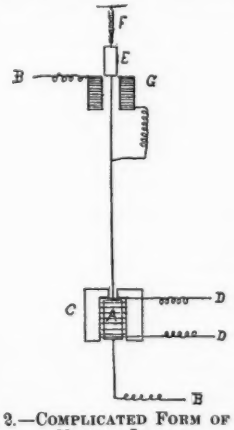


FIG. 2.—COMPLICATED FORM OF THE NERNST LAMP.

it in the focus of a reflector C as seen in Fig. 1. On the inner side of the reflector is a spiral wire of platinum D which, when brought to incandescence by a current, produces heat sufficient to render the magnesia a conductor; a current is then passed directly through the oxide by the wire B and that in the spiral is shut off. A complicated form of lamp is seen in Fig. 2. Here the magnesia A is placed within a cylinder C, which also encloses a platinum spiral D. As soon as the incandescent spiral has heated the magnesia sufficiently, a current is passed through the oxide by the wire B. Within this circuit is a coil G; which, upon becoming magnetic, draws down the iron bar E, thus lowering the now incandescent magnesia from within the cylinder. Upon breaking the circuit the coil loses its magnetism, and a spring F raises the iron bar and magnesia to their former positions.

As advantages over the ordinary incandescent lamps, Professor Nernst claims that the same amount of light can be furnished at one third the cost, and as the magnesia allows of being heated to a much higher degree than a carbon of filament, a purer light is obtained. The successful employment of a cheaper substitute for the platinum is also announced, though the name is not made public. In operating, either an alternating or direct current is used.

H. C. Cooper, of Heidelberg, in the same issue of *Science*, writes as follows:

The Nernst light requires neither vacuum nor tender filaments. The essential part of the invention is that when substances like magnesia (magnesium oxide) and clay are heated above 3,000 degrees Celsius (6,000 degrees Fahrenheit—far above the melting point of platinum), a very weak current is sufficient to keep them in an intensely luminous condition. Either direct or alternating currents may be employed, and the magnesia is little injured by use. The only difficulty that remains to be surmounted is a practical and inexpensive appliance for heating the substance to the necessary temperature. The work is, however, progressing, and those who know the ability and courage of the inventor are confident that he will succeed.

Prof. Walter Nernst, though unknown to most people, is a scholar of high rank in the purely scientific world, and his works or their translations are to be found in almost every scientific library. His brilliant researches won him the newly established chair of physical (theoretical) chemistry at Göttingen, and he is surrounded by advanced students of the most varied nationalities, all of whom greatly admire his fertile mind and genial, inspiring manner. His new invention is but another example of the benefit that patient, conscientious, scientific study is sure to bring to the whole world.

The Petersburg, Va., Street Railway has been sold at public auction to S. Kaufman for $5,500.

Electrical Review

OLDEST ELECTRICAL WEEKLY IN THE UNITED STATES.]

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STEPHEN L. COLES, - - ASSOCIATE EDITOR.
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SPECIAL NOTICE TO ADVERTISERS.

CHANGES for advertisements must be in this office by Friday noon for the following week's issue. NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week.

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It is sincerely to be hoped that Keely's alleged secrets have died with him. Twenty-five years of such chicanery and charlatanry as that with which he regaled the public is quite enough. His audacious assertions, never proved, netted him hundreds of thousands of dollars.

If those archaic Fifth avenue stages, with their travesty horses, which are an eye sore to New York city, were replaced with handsome electric omnibuses, wouldn't it be fine! The route traveled by the stages is over asphalt pavements, an ideal roadway for electric vehicles. The street-car horse will soon disappear from metropolitan thoroughfares, and the Fifth avenue stage horse will be the last ghost of equine rapid transit. May his days be few and briefly numbered in the land which he afflicts!

There was a time when the advent of electricity was regarded as a great danger and a thing to be fought against. No apparent vestige of this antagonism remains. In fact a very large proportion of our gas companies own their own electric plants. The statistics of gas companies will bear out this statement in a striking manner. It does not seem to be the object of the gas man to annihilate his competitor so much as it is to give the public the better service and thus let him die a natural death.—*Progressive Age.*

It would add materially to the fund of universal knowledge and to the gayety of nations as well were Editor Brown to publish a reliable list of electric lighting companies that have "died a natural death" as a result of gas competition.

We have received from a friend, who resides at the discreetly safe distance of Chicago, the following clipping from some irreverent publication:

"A scientist recently asserted that a man could *double his circulation* by bathing his feet in tepid water, and now some *rural editors* are having tanks fitted to their office stoves."

This "rural editor" is pleased to state that no tanks are necessary in the office of the ELECTRICAL REVIEW. Its circulation was never better, never pulsated over a wider field. During the past 60 days the office and newsstands' sales of the ELECTRICAL REVIEW have doubled—another indication that there is no need of a cold feet cure here. We throw this little bouquet in our own direction because of the excuse given us by the jocular brickbat projected by our western friend, and extend to him the assurance of our most distinguished consideration.

A HOT-BREEZE ELECTRIC FAN.

Heretofore the function of the electric fan has been to generate cooling breezes for the relief of sweltering humanity in hot weather. It would seem that there should be no serious hindrance to extending the usefulness of the electric fan and make it provide currents of heated air for warming us in cold weather. If an electric heater were constructed of the form and size of the face of the guard usually attached to electric fans and fastened to the guard, and if it were fed with current from the same source of supply as that which operates the fan, it should follow that the fan propeller would force out and distribute the warm air generated by the electric heater. Such an arrangement would be useful in warming bay-windows, cosy corners, and other places now difficult to heat, for the warm air could be forced in any desired direction.

The city of Brooklyn is just now greatly agitated over a trolley car with side doors, adopted by the Nassau line on its very extensive system. When first introduced these cars met with favor, as they are open on one side, and the several doors of the cross aisles proved a convenience for the crush of people to get on at Park row, New York. With the coming of cold weather, however, the cars prove to be very unsatisfactory, on account of draughts, inability to land passengers on crossings, and general clumsiness in construction. Mass meetings have been held and resolutions adopted condemning them. It is evident that the cars are a mistake for Winter service, and President Johnson, who is an able street-railway man, will no doubt see that a change is promptly made.

Miss Agnes Irwin, dean of Radcliffe College, who was recently chosen by Governor Wolcott, of Massachusetts, to serve on the Paris Exposition Commission, is a great-granddaughter of Benjamin Franklin. This is a delicate manner of paying tribute to Franklin, the electrical experimenter and our first ambassador to France.

A CABLE TO OUR NEW PACIFIC COLONIES.

Now that we have possessions in the Pacific, the question of ready communication therewith, both for war purposes and for commercial transactions, becomes a prominent one.

In an interview, Senator Cullom, chairman of the Hawaiian Commission, expresses the opinion that we need a cable to the Sandwich Islands, and that it eventually ought to be extended to the Philippines. A bill will be reported to Congress during the coming session embodying this recommendation. The cable should be built by citizens of the United States and of American materials.

WALL STREET AND THE ELECTRICAL STOCK MARKET.

The past week has been an active one in the stock market. The general advance in the market since the elections has been well sustained. The earnings of railways and industrial corporations, the cheapness of money and the defeat of the free silver idea have been the principal causes for the advance. It looks as if the free silver question were permanently settled, and doubtless the present material prosperity of the states which most strongly advocated it will have much to do with keeping it settled. The trade and financial returns for the week show that the activity in the stock market is paralleled in the general business situation. Nearly every industry reports progress and expansion since election day. Our exports for October were $7,000,000 greater than for the same month last year. The indications all point unmistakably to a period of solid prosperity.

On the New York Stock Exchange General Electric closed at 82 bid and 82¼ asked, a loss of ¾ point for the week. Western Union closed at 93½ bid and 93¾ asked, a decline of ¼ point for the week. On the Boston Exchange American Bell Telephone closed at 281 bid. On the Philadelphia Exchange Electric Storage Battery common closed at 50 bid and 50½ asked.

Wall Street, November 19.

A Letter From Mr. Tesla.

NEW YORK, Nov. 18, 1898.
46 and 48 East Houston St.

TO THE EDITOR OF ELECTRICAL REVIEW—*Dear Sir:*

Under enclosure I forward a copy of a letter which is self-explanatory. If you consider it a justice to me to insert it in your next issue, kindly do so.

Yours very truly,
N. TESLA.

"THE ELECTRICAL ENGINEER" ASKED TO EXPLAIN.

NEW YORK, Nov. 18, 1898.
46 and 48 East Houston St.

EDITOR OF THE ELECTRICAL ENGINEER—*Sir:*

By publishing in your columns of November 17 my recent contribution to the Electro-Therapeutic Society, you have finally succeeded—after many vain attempts made during a number of years—in causing me a serious injury. It has cost me great pains to write that paper, and I have expected to see it appear among other dignified contributions of its kind, and, I confess, the wound is deep. But you will have no opportunity for inflicting a similar one, as I propose to take better care of my papers in the future. In what manner you have secured this one in advance of other electrical periodicals, who had an equal right to the same, rests with the secretary of the society to explain.

Your editorial comment would not concern me in the least, were it not my duty to take note of it. On more than one occasion you have offended me, but in my qualities both as Christian and philosopher, I have always forgiven you and have only pitied you for your errors. This time, though, your offense is graver than the previous ones, for you have dared to cast a shadow on my honor.

No doubt you must have in your possession, from the illustrious men whom you quote, tangible proofs in support of your statement reflecting on my honesty. Being a bearer of high honors from a number of American universities, it is my duty, in view of the slur thus cast upon them, to exact from you that, in your next issue, you produce these, together with this letter which, in justice to myself, I am forwarding to other electrical journals. In the absence of such proofs, which would put me in the position to seek redress elsewhere, I require that, together with the preceding, you publish instead a complete and humble apology for your insulting remark which reflects on me as well as on those who honor me.

On this condition I will again forgive you, but I would advise you to limit yourself in your future attacks to statements for which you are not liable to be punished by law.

N. TESLA.

Mr. Charles A. Schott, chief of the Computation Division of the Coast and Geodetic Survey, has been awarded the Wilde Prize by the French Academy for his work on terrestrial magnetism.

PERSONAL.

Mr. R. J. Randolph, general sales manager of the Sterling Arc Lamp Company, New York, has left New York for a flying trip to Chicago.

Capt. T. H. Brady, of New Britain, Ct., well known in electrical circles and one of the first manufacturers of electrical goods, has been elected a member of the House of Representatives of his state. Captain Brady's many friends will congratulate him, and the state of Connecticut is assured of a capable and careful legislator.

It was announced last week that president Timothy Dwight had resigned his position as president of Yale University, and that Prof. Geo. J. Brush had resigned his position as director of the Sheffield Scientific School of Yale University. Prof. Russell H. Chittenden was elected to succeed Director Brush. Professor Brush has been made professor emeritus in the Sheffield Scientific School.

Mr. R. Edwards, Jr., of Edwards & Company, New York, manufacturing electricians, who was in Cuba as an officer of the Seventy-first Regiment of New York during the campaign, is now at his desk and again actively taking up his work in the electrical field. Mr. Edwards is one of a number of gentlemen who were volunteers from electrical ranks during the war who shed luster on the entire fraternity by their self-sacrifice and patriotism.

Mr. F. E. Drake, formerly of the Cleveland office of the Walker Company, has returned with the United States Commission to the Paris Exposition and is now at the Waldorf-Astoria. Mr. Drake has accepted the position as chief of the mechanical and electrical departments of the United States section and chairman of the committee on plans. His home office will be in Chicago, and he will make various trips on behalf of the commission-general.

Col. Jasper N. Keller, of Boston, general manager of the New England Telephone and Telegraph Company, was a New York visitor last week, after an absence from the metropolis of nearly four years. Colonel Keller is one of the old-timers in the telephone and telegraph field, and has developed his company until it is one of the solid corporations of the country. The duties and responsibilities of his important position have neither changed his youthful temperament nor good looks, and his friends in New York are always pleased to extend a cordial welcome to him when he ventures from the Hub to the metropolis of the western hemisphere.

TELEPHONE IMPROVEMENTS AND RATES IN NEW YORK CITY.

The successful inauguration, last week, of what is technically known as the common battery system in one of the large telephone exchanges of New York city marks a distinct step in advance. This means the concentration at the central office of the entire battery service and its elimination at the telephone station of the subscriber, and also does away entirely with the calling bell, the lifting of the receiver from the hook sending the necessary instantaneous signal to the operator. The signaling drop in the central office is replaced by the more accurate and unmistakable signal of a brightly lighted miniature incandescent lamp. Doubtless these improvements will be extended throughout the entire system, but a work of such magnitude will require considerable time.

This city has always been looked upon by the expert telephone engineers of the world as leading in all practical and technical work tending to increased efficiency. It is noticeable that representatives of this busy branch of the electrical field from London, Paris, Berlin, Sweden, Japan, etc., have made this city the chief center of all their investigations. This is particularly true of the past two or three years, as the personal columns of the ELECTRICAL REVIEW prove. It is safe to say that the city of New York, in respect to complete and up-to-date telephone service, stands at the head, and that is why it is the Mecca of the telephone experts of the world.

In making these observations on the telephone situation, we feel inclined to dwell upon the advanced results obtained in recent years in the great metropolis of New York city. These results reflect in a marked degree the success that follows where a great public service system is properly managed. There is undoubtedly the most complete and most costly telephone plant in the world in the territory mentioned, and service is furnished over metallic circuits to nearly 30,000 subscribers, a far larger number than in any other great capital. More than two-thirds of this large number have been added during the last five years. Such a growth indicates unmistakably that service and charges are meeting with public approval. One reason of this extension of the telephone system in New York is undoubtedly due to the fact that the rates are based on the correct theory; namely, the message rate. We have noticed, and it probably has been noticed by many others, that the annoying reply of "busy" from the central office operator is becoming less numerous day by day. This is largely due to the establishment of many branch exchanges, each with several lines to the general system, the number of lines corresponding to the amount of business. This shows that the subscriber is awakening to the fact that he should provide adequate telephone facilities, taking care that no incoming message to him is lost or delayed, and that his own outgoing calls can always be made promptly. This is good business.

Many attempts to establish telephone systems here to compete with the existing one have been announced. We should not fancy the undertaking. One of the ablest telephone men in this country, not now actively engaged, when asked recently under what terms he would install a modern competitive telephone system in Greater New York, replied, "I would want 10 years' time, and $20,000,000 of capital." The statements we have seen from time to time about establishing such a system here in a period of one or two years' time indicate ignorance of the problems involved. The practical work of a period of 20 years, devoted to securing rights, subway facilities, central office buildings and electrical improvements comprises an experience that can not be duplicated with ease. We are reminded of the military engineer who was ordered to build a bridge in a certain time, and was told that any requisition he made would be instantly honored. His first requisition was for 100 men, experienced bridge builders, each 18 feet high!

Mention should also be made of the vast increase in the use of the public telephone. The reduction of the charge from 15 cents to 10 cents has evidently proved an excellent idea, judging from the increased business to be noted at the various public telephone stations, and also the increased number of such stations. It is a convenience that we expect to see extended with all possible rapidity.

These facilities for prompt communication are particularly valuable in that they so easily connect with the long-distance system which now extends from Maine to Iowa. The fact that from every telephone station in New York, public or private, the user may talk satisfactorily to points 1,500 miles distant, excites the wonder of all visiting foreign experts.

TRANSMISSION OF POWER THROUGH THE AIR WITHOUT WIRES.

BY PROF. JOHN TROWBRIDGE IN THE "SCIENTIFIC AMERICAN."

Mr. Tesla has recently patented a method of transmitting power through the air without the use of wires. This method consists in producing a very great difference of potential between a high point in the atmosphere, reached by a wire connected to a balloon, and a distant point on a balloon, which in turn is connected through a step-down transformer with the earth. A step-up transformer produces the high potential at the sending station, or at the first balloon, and the difference of potential thus created produces a current of conduction through the rarefied air to the second balloon, and thence through the step-down transformer to earth. Mr. Tesla relies upon the good conductivity of rarefied air to high electro-motive force.

FIG. 1.—SIXTY-POINT STROMBERG-CARLSON TELEPHONE PLUG BOX.

Some recent experiments I have made with high electro-motive force are interesting in regard to the suggestion of Mr. Tesla, and are in continuation of those I described in the *Scientific American* for January 15, 1898. At that time my apparatus was capable of producing 1,200,000 volts. It can now produce 3,000,000.

Up to the point of 1,500,000 volts the length of the electrical discharge in air appears to be closely proportional to the electro-motive force. When this voltage is exceeded, the length of the spark no longer increases in proportion to this force, for instance, and electro-motive force of, approximately, 3,000,000 volts produces a spark of about seven feet in length, when it should excite one at least 10 feet long. The reason of this diminution is readily seen when the operation of my apparatus is examined in the dark.

From both terminals, and from the conductors to those terminals, there is a luminous brush discharge to the walls and floor of the room. The main portion of the discharge is, so to speak, shunted through the air, which breaks down with facility at such high voltages. The high electro-motive force exerts a similar action to that of diminished air pressure.

In the case of rarefied air, one sees the luminous area of discharge on the positive terminal extend farther and farther from the point of the terminal, thus indicating that there is an increased flow through the rarefied air. In ordinary atmospheric air the same increase of electrical conductivity takes place under the action of great electro-motive force. When discharges produced by 1,000,000 volts or more are excited between terminals six feet apart, in tubes filled with water, the tubes are speedily burst, and when the phenomenon is carefully examined, it is perceived that the disruptive sparks occur on the surface of the water inside the tubes, which vaporize the water and thus lead to an explosion. The layer of air conducts more readily than the water. The same phenomenon can be shown by interposing a conductor made of plumbago and infusorial earth, making a resistance of about 10,000 ohms between the terminals of the apparatus. A spark passes over the surface of such a conductor through the air, if the length of such a conductor does not exceed 10 or 12 inches.

I found also that the spark preferred to jump through five centimeters of air to passing through 1,000 ohms of a copper sulphate solution. Thus the air evidently breaks down with increasing readiness when the electro-motive force is increased beyond a certain limit.

One of the most striking experiments in this connection can be performed by coating a board with a thin layer of plumbago, which is polished upon the surface in such a manner as to make a resistance of about 1,000 ohms between broad terminal bands of copper. When a discharge under a difference of potential of 1,000,000 volts passes between the terminal bands, the entire surface of the conductor becomes luminous.

When my new apparatus was first set up, the coated surfaces of the Leyden jars were not more than a foot from the floor. On account of the great loss due to electrostatic induction, I determined to have the entire apparatus lifted three feet from the floor. A certain portion of the loss was thus obviated, but when discharge takes place, sparks an inch long can be drawn from the neighboring brick walls, and the entire room seems to be filled with brush discharges.

I believe, therefore, that beyond 1,000,000 volts, the length of the spark is no longer proportional to the voltage, and that this departure from proportionality is due to the initial resistance of the neighboring air becoming less and less. In order to get the full effect of the voltage of my machine, I believe that it should be placed 30 or 40 feet above the earth and at a distance from neighboring masses. The apparent length of lightning discharges at low altitudes is therefore no criterion of the voltage which produces these discharges; for there must be great leakage, which necessitates an excess of electro motive force to produce the discharge. On the other hand, the discharges in higher regions of the atmosphere are much lengthened on account of the increased conductivity of the medium.

In view of the experiments which I have described, I am led to believe that ordinary atmospheric air under very high voltage acts like a fairly good conductor, and I can conceive of such a high electro motive force that the initial resistance of air might not be more than the resistance of metals. The loss of electrical energy in producing difference of potential of 3,000,000 volts at a distance of 10 feet from the terminals of my machine is very great, and in employing such high voltages Mr. Tesla could only obviate great loss by lifting his entire generating apparatus far above the surface of the earth.

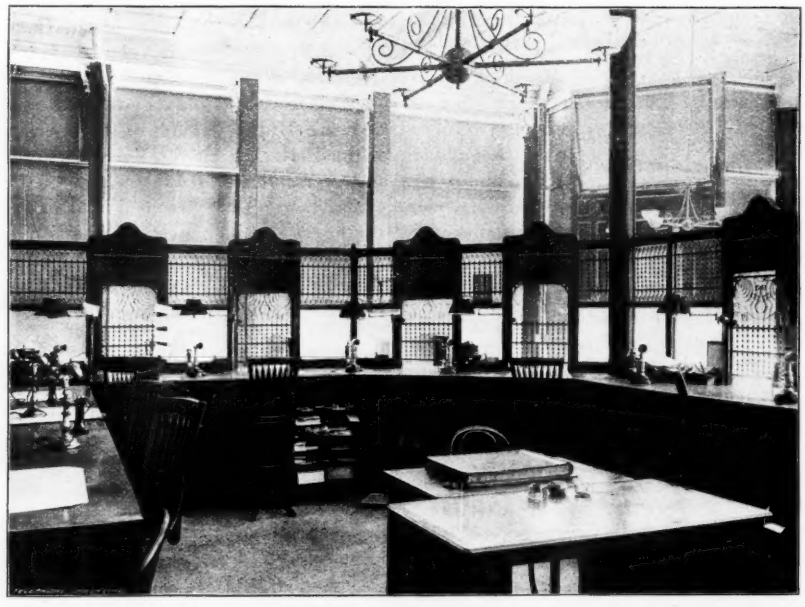


FIG. 2.—VIEW OF OFFICE EQUIPPED WITH STROMBERG-CARLSON DESK TELEPHONES.

THE EARTH AND ITS ATMOSPHERE.

A CRITICISM AND ITS ANSWER.

AN INQUIRY.

To the Editor of Electrical Review:

In your issue of November 2, in an article dated New York, October 29, and entitled "Tesla's Aerial Power Transmission," T. J. M. says: "What, then, should be the effect of the earth rotating at its enormous speed *under the friction of the atmosphere*—a globe billions of times the surface of the archaic electric machine?"

If I am not mistaken, there is no "friction of the atmosphere" *with the earth*. The atmosphere moves with the earth. Did it not, we should be swept from its surface by the enormous velocity of our motion through the atmosphere.

There is no friction at the "*upper*" surface of the atmosphere, for there is absolutely nothing to cause friction.

It seems to me that T. J. M. must seek another explanation of the source of electricity that causes the electrical phenomena of the atmosphere.

S. R. M.

Ithaca, N. Y., November 4.

THE ANSWER.

To the Editor of Electrical Review:

If "S. R. M." had read discriminatingly he would have understood differently. As a whole, the earth and its atmosphere move together, or at least the text-books teach the student to consider the fact settled. But there are great disturbances constantly happening in the air and over vast areas and which can have tremendous effects capable of giving astonishing electrical manifestations, and in the upper strata electrical excitement of a most intense character would not, if manifested, cause any surprise to the modern thinker. What is a storm, if it be not a condition attended by the friction of the lower strata upon the earth's surface, and probably of the lower strata against the higher strata of air? Yet the storm may be, and often is, raging furiously over an area of a million square miles or more.

In the absence of the right sort of data namely, observations and records of what is going on away up in our atmosphere, no one can say what is the primary cause of these great areas of high and low pressure.

Many days one can look up and observe several strata of clouds, each layer moving in an independent direction, proving the existence of stratum-friction, the clouds being merely the finger-boards or pointers, and having no relation to or bearing upon the fact of independently moving layers of air and the friction necessarily occurring.

And what is the cause of the steadily moving trade-winds in different parts of the world? Why is it that in a given locality the most destructive wind-storms always blow in the same direction? Text-books to the contrary, it is by no means demonstrated that there is no friction between the earth and its atmosphere. It is quite easy to conceive the idea of some friction, and easy to understand how the differential "winds" thus caused can take all sorts of directions. And a very little of that kind of disturbance could generate stupendous amounts of electricity. And it is quite as easy to believe—indeed, it would seem necessary to believe—that there are in the atmosphere movements just like the ocean tides, since air is as subject as water to the laws of gravitation.

T. J. M.

New York, November 12.

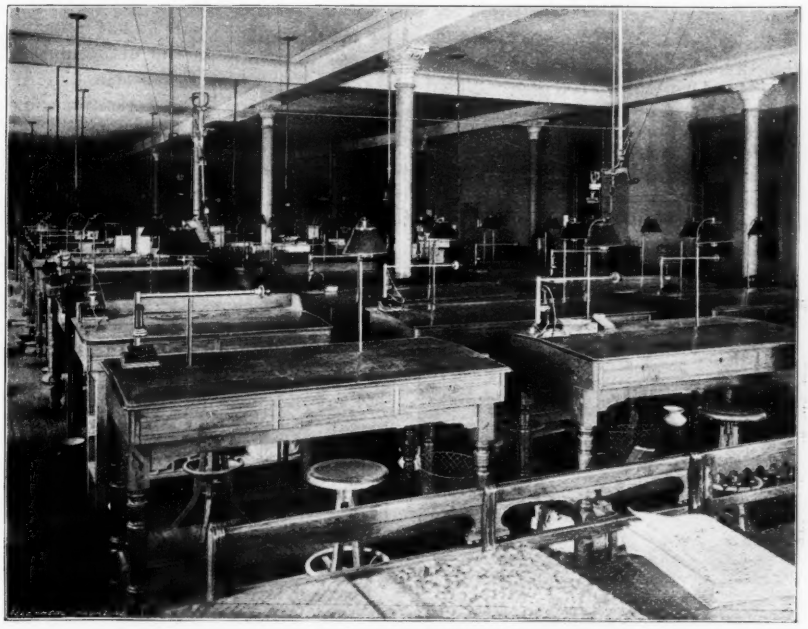


Fig. 3.—Bookkeeping Department Equipped with Stromberg-Carlson Desk Telephones.

An Extensive Interior Telephone System.

An unusually large and conveniently arranged intercommunicating telephone system has recently been installed by the Stromberg-Carlson Telephone Manufacturing Company, of Chicago, in the new offices of the People's Gas Light and Coke Company, Michigan avenue and Adams street, Chicago. This modern plant affords a good example of the extent of the use and convenience of private telephone systems. In Fig. 2 is shown an interior view of one of the gas company's application offices on the main floor, showing six private telephone instruments, one at each window, and also three telephones connected with the public exchange. Each office on this floor is equipped with a portable desk telephone and a 60-point plug-box like that illustrated in Fig. 1. Any of these instruments can be directly connected with any of the instruments in the bookkeeping department, a view of which is shown in Fig. 3. At each bookkeeper's desk is a long swinging arm telephone and plug-box, and any one of these instruments can also be directly connected with any of the offices on the main floor.

In this system the telephone user is not obliged to first call the operator at the central exchange, but completes the calling circuit to the station wanted by inserting a plug in the number desired, regardless of where the plug of the instrument called may be. Thus, should a user neglect to disconnect an instrument when through, or fail to replace the plug in the home number, it does not prevent that station from being called by any other. The talking circuit is completed by the person calling placing the plug in the home number.

Besides the system between the bookkeeping department and the offices on the main floor, and entirely independent of it, is a system of the same kind between the officers of the company and the heads of departments. In Fig. 4 is illustrated a pedestal, which stands beside the desk in the president's private office, with a desk telephone and plug-switch for the office system and a telephone connected with the public exchange. These pedestals are supplied with the private system, and are specially made to accommodate the public exchange telephones as well as private plant instruments.

The regular Stromberg-Carlson long-distance telephones are used in a system of this sort and in cities where independent public telephone exchanges have been established, the private system is connected directly with the public exchange, and the separate telephones are not required. The system can be installed with a generator call-bell or battery call.

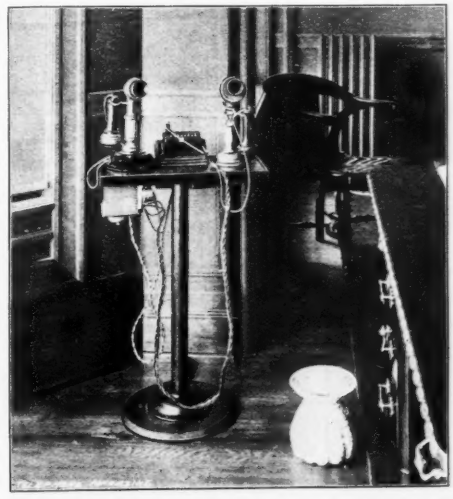


Fig. 4.—Stromberg-Carlson Pedestal Telephones.

Where the distances are not too great the battery call is the most convenient, and where a large amount of outside construction is required the generator call is considered the most satisfactory. In the battery-call system, the ringing and talking batteries may be placed at the central office.

Telephone News .....and Comment

It is rumored that an automatic telephone system may be installed by local capitalists at Columbus, Ohio.

It is rumored that the gentlemen who were the projectors of an independent system to be constructed in Wichita, Kas., have abandoned the scheme.

The Cincinnati Bell Telephone Directory for November has been issued by the City & Suburban Telegraph Association. As usual, it is a model of good arrangement and convenience.

Mr. E. C. Spaulding, of Atlanta, Ga., has been appointed temporary receiver by Judge Emory Speer for the Augusta, Ga., Telephone and Electric Company. The petition was filed by Marion Erwin, attorney for Thomas & Post, New York.

The work of installing the telephone system between the various offices of the new City Hall at Peoria, Ill., is in progress. Seventeen offices are supplied with telephones, and each has a switchboard with 16 numbers, thus allowing any office to readily converse with any other office in the building.

Mayor Lang recently sold to the two highest bidders two franchises to operate telephone lines in Paducah, Ky. The Kentucky Electric Company bought one for $100 and the American Telephone Company the other for $15. The East Tennessee Telephone Company did not bid. It is operating the present telephone system in Paducah.

The Missouri & Kansas Telephone Company and the American Telephone and Telegraph Company on November 15 opened the long-distance telephone lines from Kansas City, Mo., to St. Louis and the East. The opening was under the auspices of the Kansas City Commercial Club, and was held at the club rooms at 8 o'clock in the evening. Addresses were made, music was sent by telephone, and other demonstrations were made showing the possibilities of long distance telephone communication. Light refreshments were served. The ELECTRICAL REVIEW is indebted to Secretary N. R. Ferguson, of the Missouri & Kansas Telephone Company, for an invitation to be present.

The City Council of Niles, Mich., and the local Bell Telephone Company are on the verge of an interesting dispute. When the late Gilliland system was working, the Bell company furnished the city with two telephones free of charge. Since the Gilliland system has gone out of existence the Bell people have presented bills for telephone rentals, and threaten to remove their instruments if they are not paid. The bills, it is said, will not be paid, and, in turn, the mayor and aldermen declare if the telephone company attempts to carry out its threats they will order every pole and line removed from the city, for the Bell company, it is claimed, was never granted a franchise in Niles. Interesting developments are expected.

Trolley cars began to run on the North Hudson County Railway Company's Grove street line from Jersey City to Hoboken on November 17, and in a few days the last horse-car line in Hudson County will have become a thing of the past. The trolley line extends south only as far as Grove street and Newark avenue, and until arrangements have been made with the North Jersey Street Railway Company to run the cars over their line from that point to the ferry, passengers will be transferred to the terminus by horse cars.

A Chloride Accumulator for Electric Vehicles.

The Electric Storage Battery Company, of Philadelphia, is now manufacturing a special type of chloride accumulator for electric vehicles which they designate as type "M.V." 7, and which is illustrated herewith. These cells embody the best type of construction for this special service, where weight is of so much importance. The capacity per pound of cell has been greatly increased over the company's standard types, while the efficiency and durability, it is said, have been greatly improved over previous types for this class of work. Cells of this special construction have been exclusively adopted and are extensively used by the Electric Vehicle Company in operating their electric cab and livery business in New York city on a large scale, and also the Pope Manufacturing Company (motor carriage department), of Hartford, Ct., in their numerous types of automobiles. Results are reported to have been most satisfactory in these applications, and have demonstrated conclusively that electric vehicles are commercially successful and economical in operation.

A CHLORIDE ACCUMULATOR FOR ELECTRIC VEHICLES.

The containing jars of the various sizes of these cells are made as light as consistent with the requirements of this service, and they are not heavy enough for use except where contiguous cells or sides of trays afford them proper support.

Death of J. E. W. Keely.

John E. W. Keely, the "Keely Motor Man," died at his home in Philadelphia, on November 18. He was born in 1837. For twenty-five years he had posed before the public as the discoverer of a new force in nature. He had a great jargon of alleged scientific knowledge with which he impressed many credulous people and secured large sums of money. Among these was Mrs. Bloomfield Moore, of Philadelphia, who is said to have given Keely over $100,000 at various times. None of his alleged inventions was ever patented.

New Members of the New York Electrical Society.

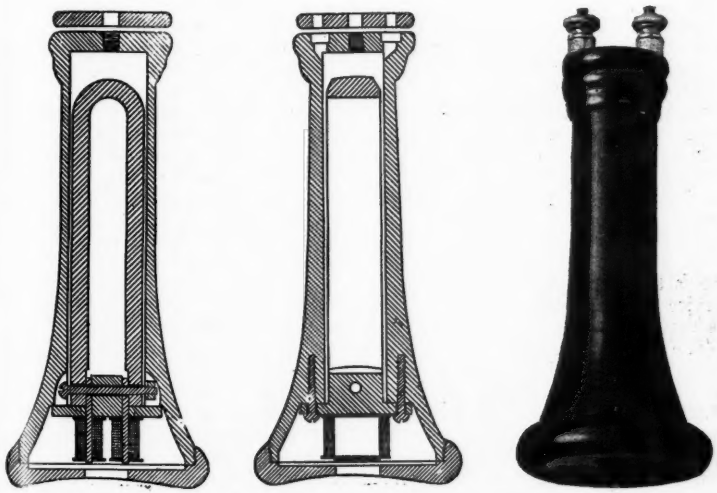
At the meeting of the New York Electrical Society, held on November 17, the following 25 new members were elected:

Prof. J. Burkitt Webb, Stevens Institute, Hoboken, N. J.; Hubert Greaves Webb, Glen Ridge, N. J.; Henry V. Parsell, 31 East Twenty-first street, New York city; Joseph White Stickney, 76 Hicks street, Brooklyn, N. Y.; Augustus Treadwell, Jr., Electric Storage Battery Company, 20 Broad street, New York city; Morton Arendt, 42 West 126th street, New York city; W. G. Burns, 423 West 117th street, New York city; Theo. H. Joseph, 32 East Seventy-fourth street, New York city; Bernhardt Hoffman, New York Telephone Company, 15 Dey street, New York city; W. I. Thompson, 136 Sumner avenue, Newark, N. J.; Frank R. Wainwright, Chesley Electric Company, 20 Cortlandt street, New York city; Thomas J. Buckley, Tenafly, N. J.; St John P. Chilton, 11 West Thirty-ninth street, New York city; William Newton Ryerson, Montclair, N. J.; Thomas J. Fay, Electrical Engineer School of Correspondence, 120 Liberty street, New York city; J. E. Woodbridge, editor *Electrical World*, 9 Murray street, New York city; Charles E. Dustin, Excelsior Electric Company, Brooklyn, N. Y.; Henry B. Cutter, 1112 Sansom street, Philadelphia, Pa.; Alexander McGill, 1190 Madison avenue, New York city; Charles T. Child, electrical editor *Engineering Magazine*, 120 Liberty street, New York city; Lieut. W. D. Weaver, *American Electrician*, 26 Cortlandt street, New York city; Dr. Louis Duncan, Empire Building, New York city; A. E. Clifford, *American Electrician*, 26 Cortlandt street, New York city; A. Stamm, Chesley Electric Company, 601 Newark street, Hoboken, N. J.; V. C. Gilpin, Cutter Electric and Manufacturing Company, 120 Liberty street, New York city.

New Bipolar Telephone Receiver.

A telephone receiver has recently been developed which is designed to obviate many of the troubles, particularly that of variation of adjustment, which seems worthy of description.

It is to be known as the "W & C" receiver and is of the bipolar type, excellently finished and modeled, showing careful workmanship as to the mechanical and electrical design.



FIGS. 1, 2 AND 3.—NEW "W & C" BIPOLAR TELEPHONE RECEIVER.

The cuts, Figs. 1 and 2, represent the longitudinal sections of the receiver, showing the heavy magnet, brass spools, and the new method of fastening the interior of the shell, so that expansion and contraction from atmospheric changes of the shell affect the adjustment in no way. As will be seen by the cuts, the magnets are secured to the pole-pieces by a bolt, which binds the two together upon the brass bed-plate. Thus the whole interior is as one piece. This is all held in the shell by two machine screws at a point so near the diaphragm that the shell can contract or expand without changing the adjustment.

The pole-pieces are nickel-plated brass, and the soft iron cores are milled off absolutely even and parallel. Wherever the connections from pole-piece and magnet occur the surfaces are milled, thus giving the best possible contact space.

The shell is of the best hard rubber and is turned off and polished. The interior of the shell is not round, but is rectangular, with the corners rounded, thus forming a close fit for the magnet and giving great strength to the shell itself.

The aim of the makers, Messrs. Whitman & Couch, 190 Summer street, Boston, is to have this piece of apparatus, which is perhaps the most important in the whole realm of telephony, become recognized as the most successful receiver yet developed.

Electrical Construction in New York State.

Electrical construction interests throughout New York state are in an unusually prosperous condition at the present time. Mr. W. C. Ballda, manager of the Utica Electrical Manufacturing and Supply Company, informs the ELECTRICAL REVIEW that among the installations of plants which they are now making are: 150-light equipment for the Perkins

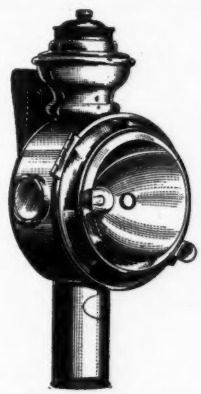


FIG. 1.—ELECTRIC CARRIAGE LAMP.

Lumber Company, at Parkers, N. Y.; a 250-light plant adapting an "Eddy" dynamo and "Jandus" arc lamps at the New York Mills, New York Mills, N. Y.; at Waterville, N. Y., an interesting installation is being made for Mr. M. W. Terry. A 250-light "Eddy" dynamo is being used, and water-power will be gotten by a "Munson" water-wheel This plant will be for lighting Mr. Munson's private residence, and several residences of neighbors in the same vicinity. The Utica company has also been awarded by the Municipal Commission of Herkimer, N. Y., the contract for remodeling the arc lighting plant and for putting in a new 200-horse-power Corliss engine, a 50 horse-power high-speed 275-kilowatt two-phase Westinghouse alternator, and construction work for 5,000 incandescent lamps, in addition to the arc system.

Electric Heating.

The development of electric heating systems is well illustrated by an examination of the recent catalogues and descriptions issued by the American Electric Heater Company, Detroit, Mich. The variety of apparatus now includes almost every form that might be required, and in some of the devices the success is so marked that they ought entirely to do away with the old forms and methods; for instance, the soldering irons, which are heated and maintained at the right heat by flexible wire running to the handle, which permits their use freely; the electric laundry irons and tailor irons, which are made similar in principle to the soldering irons, though, of course, adapted for their specific purposes. The portable electric air heaters made by this company are also unique and operate successfully, giving a soft heat, which is noticeable, because no odor is

FIG. 2.—BATTERY FOR ELECTRIC BICYCLE AND CARRIAGE LAMPS.

evident. This little device consumes about one watt per cubic foot of air to be heated when the maximum heat is desired, and operates on an ordinary 110-volt current, though it is wound for any voltage up to 250. This is peculiarly designed for small rooms, as the heat becomes apparent very quickly after the current is turned, and can be as instantly shut off when the right temperature has been reached. The American Electric Heater Company would be glad to send illustrated catalogues and information on application.

An Electric Bicycle Lamp.

The United States Battery Company, of New York city, has recently brought out an electric storage battery in miniature, which is meeting with excellent success as a lamp for bicyclists. The battery is very compact, as shown from the illustrations we present, and the company has evidently struck that happy mean as to price and cost of renewals that will undoubtedly prove satisfactory to a large clientage. It is stated that the batteries will furnish a steady light from 12 to 15 hours, and as a great number of supply depots are being arranged for it will be an easy matter for the users of this lamp to make exchanges of impaired batteries for new ones, and the expense is remarkably small.

The batteries are also adapted for house lamps and carriage lamps and new designs have been made for this purpose. The company is at present located in Twenty-third street, New York city, but has arranged for a large factory on Flatbush avenue, Brooklyn, and will have downtown offices in this city. Mr. H. W. Darling and others are identified with the company.

The ELECTRICAL REVIEW has received from the secretary a copy of the report of the seventeenth annual meeting of the American Street Railway Association, held in Boston, September 6–9, 1898. The pamphlet is embellished with a handsome steel engraved portrait of president Albion E. Lang, of Toledo, Ohio.

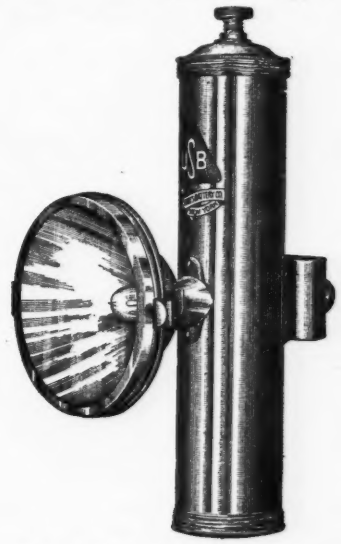


FIG. 3.—ELECTRIC BICYCLE LAMP.

HIGH-VOLTAGE POWER TRANSMISSION.

READ BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, OMAHA, JUNE 30, 1898, BY CHAS. F. SCOTT.

Several years ago an investigation of the conditions and requirements incident to the use of high voltages was undertaken by the engineering department of the Westinghouse Electric and Manufacturing Company. In this experimental investigation the size of the apparatus and the conditions of the tests were as far as practicable such as would prevail in actual work.

The transformer, the *sine qua non* of high-voltage working, received first consideration. A design suitable for large sizes was worked out and tested; then high-voltage windings were made. Attention was next directed to the line insulator.

New phenomena were liable to be presented at higher voltages, and it was necessary to determine what they were, also how to meet the requirements which they impose. New forms and sizes of insulators were designed, made and tested to determine the losses which would occur and the limit at which they would break down.

The luminosity and the hissing sound emitted by the connecting wires of high voltage suggested a loss which might be an appreciable addition to that over the surface of the insulators. It was found that a very considerable loss of energy took place between the wires—a loss which at high voltages was much in excess of that across the surface of the insulators.

Mr. L. L. Nunn visited Pittsburgh at this time and became much interested in this work. He was a pioneer in power transmission, having put in the first large alternating-current transmission plant in this country; namely, that at Telluride, Colo., which was designed by the writer and described by him* at the general meeting of this institute in 1892. It was proposed that this work be taken up conjointly by the Westinghouse company and Mr. Nunn, and prosecuted on a much enlarged scale, by operating the original motor over a high-voltage line. In a report to the vice-president and general manager of the electric company, dated April 2, 1895, the writer said: "The transformers would be arranged to give a line pressure of 10,000, which is to be increased by suitable steps to possibly 50,000 volts. * * * I regard this as an excellent opportunity to make a thorough and extremely important and valuable test of high-tension working under difficult practical conditions, which our company should take up and carry out as fully as possible." Raising and lowering transformers were made and sent to Telluride, and power for the 100-horse-power synchronous motor was transmitted at voltages far exceeding any which had been previously used anywhere. Exceptional facilities were afforded for observing the practical operation of high-tension working under severe climatic conditions, and for making measurements. The results of the work were so assuring that the Telluride Power Transmission Company has lately installed a plant which is in commercial operation at 40,000 volts and is now making an increase in the plant. This work has been continued on experimental circuits at East Pittsburgh, and some measurements have been made at Niagara.

The work which has just been briefly described was an investigation into an unknown field. It has been progressively and systematically carried out, and it has determined results which were unforeseen, and which are of both theoretical interest and practical importance.

This present paper describes the more interesting and important parts of this work, and gives the methods by which measurements have been made and the results which have been reached. A number of points of interest and importance are given with regard to long-distance transmission plants now in operation.

In 1891 the Westinghouse company furnished transformers for the 10,000-volt transmission to San Bernardino and Pomona. Twenty transformers were used in a set, each giving a pressure of 500 volts and the 20 in series 10,000 volts. This arrangement made the insulation within the individual coils a matter of comparative ease. The insulation between the coils of the high-tension circuit and other parts of the transformer was secured by allowing a space, which was filled with oil.

The first arrangement of transformers for giving from 30,000 to 50,000 volts was made by using a number of transformers, each giving 10,000 or 15,000 volts. The low-tension circuits of the several transformers received current from an insulating transformer in which there were a number of separate coils, each one supplying a separate raising transformer. An arrangement of this kind was used for obtaining the high voltages in the exhibit of the Westinghouse company at the World's Fair. A large transformer was designed in January, 1894. The output of 200 kilowatts was many times greater than that of any transformers which had been made by the Westinghouse company. The transformer was oil-insulated and was cooled by water flowing through a pipe immersed in the oil. This transformer was pronounced a success, and the type was adopted and has been followed ever since as a standard, except that the water-cooling is employed only on the largest sizes.

The transformer was then rewound for 40,000 volts and a somewhat reduced output. It was operated at this voltage for a short time, when it was found that through an oversight the insulation between layers was insufficient. In October the high-tension coils were rewound for 60,000 volts, and the transformer is still in use after many months of varied service and a considerable period of inactivity.

The making of a single large transformer for a very high voltage naturally involved new difficulties. Above 10,000 or 20,000 volts there was an unexplored and uncertain field in the matter of insulation. Materials which were commonly used at ordinary voltages might have very different characteristics under the new conditions. Tests were made on materials before the first high-voltage transformers were made, and it has been continued. The large high-tension transformer as made to-day was not designed in a week or a month, but it has been an evolution based upon experimental tests and experience in continued operation.

After a high-voltage transformer was constructed, the insulator naturally presented itself as a fundamental factor in transmission. The requisites of an insulator for high-voltage work are that it shall have a dielectric strength sufficient to prevent the current passing directly through the material, that its dimensions shall be large enough to prevent the passage of current over the outside of the insulator to its support, and that the resistance, both of the material and its surface, shall be sufficiently high to prevent undue loss of energy. In addition to these fundamental electrical requirements are those of a mechanical nature involving strength and convenience. These properties must of course be permanent, and not liable to deterioration while in service.

Up to this time very little attention had been given to the manufacture and design of high-tension insulators. There were available for our laboratory tests the glass insulators which we had designed for the 10,000-volt transmission line at San Bernardino and Pomona, California. (See paper of Mr. G. H. Winslow,* before the general meeting of the institute in 1895.)

A much larger glass insulator was made having the so-called "helmet" form, which was probably the beginning of a type which is now quite common. The large glass insulator presented mechanical difficulties in manufacture, and recourse was had to porcelain. An insulator was designed to be under-hung, the top of the insulator being supported in an inverted cup which was to be bolted to the under side of the cross-arm. From the bottom of the insulator a pin extended which was anchored in a hole in the insulator and held the wire several inches below the porcelain. The object was to place the wire below the cross arm so that the snow which might pile up on the cross-arm would not come near the insulator. The wire, moreover, instead of being supported upon the top of the insulator, where it is in connection with an extended wet surface, would be supported from the part of the insulator which is most protected and the driest.

An interesting evolution then began to take place in the manufacture of porcelain. There were eight or ten steps in this history, in which insulators which were presumed by the manufacturer to be satisfactory were broken down on high-voltage test. Porcelain which presented a beautiful, smooth, glazed surface was often found to contain internal cracks or cavities which were soon traversed by the current. In other cases bits of pebbles or other impurities were found. In still other cases the porcelain was not homogeneous and was not compact, or the material was porous and absorbed a drop of ink almost as readily as a lump of sugar would do. The effect of this work is seen in the improved quality of material now made by certain porcelain manufacturers who benefited by this experience. It may also be remarked that some of the unpleasant experiences with porcelain insulators might have been prevented if similar preliminary tests had been made instead of employing the more expensive and inconvenient method of testing them in commercial service.

The under-hung form of porcelain insulator, however, did not prove successful nor satisfactory. The insulator was heavy and cumbersome, and no satisfactory method was devised for holding the wire. A wooden pin lacks strength, and a metal pin reduces insulation. Moreover, smaller insulators of the ordinary form were found suitable for higher pressures than was anticipated.

Some measurements were made of the losses on the Pomona insulators. Twenty-four insulators were mounted on wooden pins. A wire was run along the tops of the insulators and a second wire connected the pins. The increase produced in the reading of a wattmeter in the primary of the raising transformer when the wires were connected to the high-voltage terminals was taken as the loss on the insulators. The loss at 25,000 volts was about two watts per insulator. This voltage between pin and wire corresponds to 50,000 volts between transmission wires.

(*To be continued.*)

*Transactions, vol. ix, p. 425.

* Transactions, vol. xii, p. 405.

TROLLEY FOR LONDON.

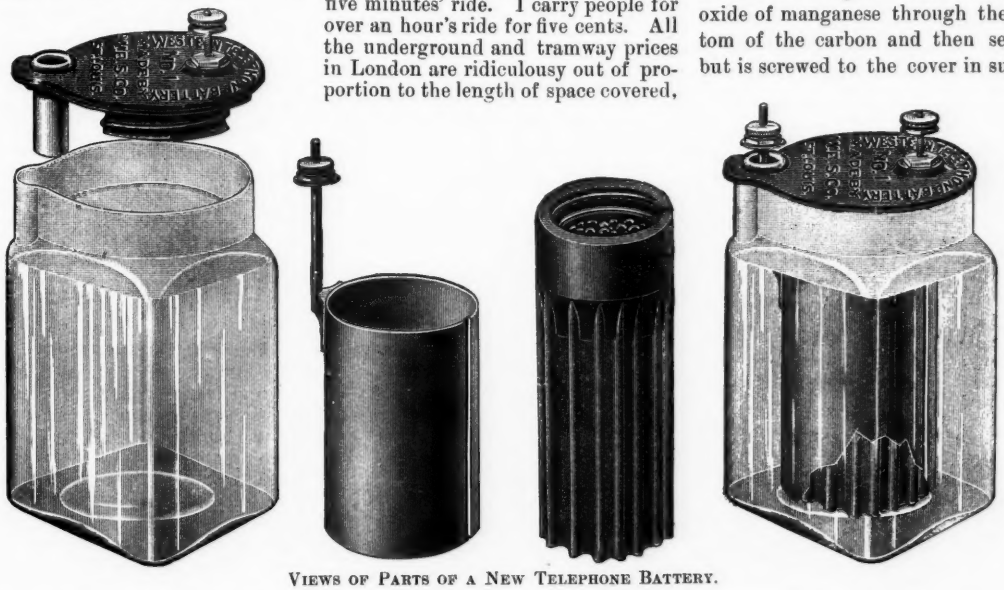
ALBERT L. JOHNSON ON RAPID TRANSIT FOR THE METROPOLIS.

The London correspondent for the *Mail and Express*, New York, sends the following interview, relating to the visit of a prominent street railway official to that city:

Mr. Albert L. Johnson, of the Nassau Electric Railroad Company, of Brooklyn, is in London with English electricians and capitalists in connection with the proposition to introduce electric street railways in London. Mr. Johnson is the brother of former Congressman Tom L. Johnson.

Mr. Albert Johnson himself has probably had a hand in constructing more electric railways than any other one man in the United States. All the Indianapolis, Cleveland, Johnstown and Brooklyn lines were built under his direct supervision, and when it is considered that the Nassau line in Brooklyn alone includes 150 miles of electric railways, and that the Johnstown and East Liverpool suburban lines are from 20 to 30 miles in length, Mr. Johnson's experience as an electric railway constructor may be determined. I met Mr. Johnson at the Cecil this evening, and on the proposition as to the possibility and necessity for electric lines in the city of London, he said:

"There is no doubt in the world that in the next 18 months electric railways will have gained a decided footing in the city of London. I have been invited here to consult with other experts on the proposition, and whether I or some one else puts in these lines makes little difference. They are bound to come. I have been engaged for the last 10 days in looking over the entire field, and I can safely say that there is no place where the natural conditions for electric street railway construction are so good or where there is such a demand for them as in this great city. The cab system of London is perfect, but every American knows the cab horse is a fossil. The electric cabs already point to the graveyard of the London cab horse. There is no reason why the congested condition of London traffic should continue 24 hours, for the modern electric car is more easily handled and, in all ways, better adapted to the rapid transportation of large numbers of people than any automobile vehicle that has yet been devised. I was amused and interested in my exploration of the new electric underground railroad. I have heard a great deal about its porcelain-lined walls and rapid means of communication. Well, the stations are porcelain lined, but the rest of the tunnel is not, and it only runs for a short distance, from a point near the Bank of England to Waterloo station. They charge you six cents for five minutes' ride. I carry people for over an hour's ride for five cents. All the underground and tramway prices in London are ridiculousy out of proportion to the length of space covered, and there is no reason why people should not travel just as cheaply here as they do in New York. As I said before, there is the greatest opportunity for electric railway construction in London offered by any place in the world, and it is the only solution to the vexed question of congested London traffic. I expect that some definite results will be obtained within a short time, and assure you that the *Mail and Express* will have the first opportunity to announce them when they are concluded."



VIEWS OF PARTS OF A NEW TELEPHONE BATTERY.

New York Electrical Society.

At the meeting of the New York Electrical Society, held at the College of the City of New York, last Thursday evening, Mr. Edward H. Johnson, president of the Sprague Electric Company, of New York city, delivered an address, entitled "Surface Contact Railways with Special Reference to the Johnson-Lundell System." The address was illustrated with numerous lantern slides, and a large attendance of members and visitors was present.

A New Telephone Battery.

The accompanying illustrations show a new telephone battery just placed upon the market by the Western Electrical Supply Company, of St. Louis. This battery has been specially designed for telephone work, and the minor details of construction, which are so often overlooked, have been considered with great care. For instance, the carbon binding-post doesn't protrude through the carbon, thus allowing corrosion to gradually spoil the connection, but is tightly screwed in through the top and then made secure with hot solder. This makes a connection which can not corrode and one that will not work loose. The carbon cylinder is not filled with the granulated carbon and oxide of manganese through the bottom of the carbon and then sealed, but is screwed to the cover in such a manner that it may be easily removed and refilled. The carbon used in the battery is of selected stock, and great care has been taken in making the selection to procure carbon especially adapted for the work the battery is designed to perform. All the parts are carefully constructed and assembled. The rod on the battery zincs is mounted on the cylinder in such a manner that it can not come loose, as a shoulder is placed on the zinc to hold it firmly in position. The cylinder is also rolled from very heavy metal, giving it an unusually long life. The battery cover is made of one solid piece of carbon, thoroughly saturated with paraffin. This, it is claimed, positively prevents the creeping of salts over the battery top, causing consequent corrosion of the connection. The zinc rod is carried through the battery top in a porcelain sleeve.

The glass jars are made from the purest white flint glass of a high degree of toughness.

Electric Lighting of Brooklyn, N.Y.

The Kings County Electric Light and Power Company, which less than a year ago was organized by Mr. A. M. Young, has now become so strong that it includes all the electric lighting companies of Brooklyn, a city of nearly a million and a half of inhabitants. The property of the Edison Electric Illuminating Company last week passed into the control of the Kings County company, which now owns in addition the Citizens' Illuminating Company, the Municipal Electric Light Company and the Amsterdam Electric Light, Heat and Power Company. The president of the Kings County company is Hon. Felix Campbell, and others interested are Mr. A. M. Young, Hon. Anthony N. Brady, Mr. Walton Ferguson, Hon. Wm. Berri and Mr. Seth L. Keeney. The consolidation will result in some radical changes in the management and undoubtedly in a great saving, estimated at $200,000 or more per annum, in the operating expenses.

The organization of the Edison company will be continued for awhile. The new officers and directors elected last week were Bernard F. Gallagher, president, in place of Ethan Allen Doty; Henry Siebert, vice-president, in place of Edwin Packard; Mr. A. W. Dater, treasurer, and as directors Messrs. Gallagher, Siebert, Dater, James N. Wallace, George A. Price, Thomas E. Murray, William F. Sheehan, John G. Jenkins, Nicholas F. Brady, Horace C. Du Val, Royal C. Peabody and Julian D. Fairchild.

Death of Latimer Clark.

The death is announced in England of Mr. Latimer Clark, the well known electrical and telegraph engineer and inventor. Mr. Clark was born in 1822, and in 1847 became assistant engineer of the Electric Telegraph Company. Shortly after he was made chief engineer of the company and at once began to invent. He was one of the first to call attention to the retardation of electricity through a covered wire by induction, and to insist that a high potential was of no advantage for transmitting signals through a cable. Clark's standard cell is what his name will be most closely associated with in the history of electrical science. Its use in the laboratory, as well as in general testing work, is almost universal. Mr. Clark was the author of a number of standard electrical works and was a partner in several electrical and business houses.

ADVANCE INFORMATION

New Electric Railways.

BALTIMORE, MD.—The Bay Ridge Electric Park and Steamboat Company will expend about $40,000 for the construction of electric towers, casino, midway plaisance, etc., at Bay Ridge.

AURORA, IND. — The Cincinnati, Lawrenceburg & Aurora Electric Street Railway, with a capital stock of $10,000, has been incorporated.

KANSAS CITY, MO.—The Jackson County Electric Railway Company has been incorporated; capital stock, $70,000; incorporators, F. W. Sears, Annie G. Lightner, J. J. Hoover and others.

CAMDEN, N. J.—The Camden & Suburban Railway Company's trolley line from Market street ferry to Merchantville is being rebuilt.

CHICAGO, ILL.—The United Traction Company has been incorporated; capital stock, $500,000; incorporators, Albert E. Wilson, Anson E. Meanor and Louis J. Bohan.

New Telephone and Telegraph Companies.

LOCK HAVEN, PA.—The new line of the Central Pennsylvania Telephone and Supply Company between this city and Renovo is about completed.

PORT HENRY, N. Y.—The telephone line to this place has been completed.

GREENSBURG, N. Y.—The County Telephone Company has been incorporated; capital, $3,500.

GLENS FALLS, N. Y.—The work of constructing a telephone line on the west shore of Lake Champlain, from Whitehall to Plattsburg, has been completed. The line also extends to Upper Jay, Ausable Forks, Keeseville, Elizabethtown, Keene and Westport.

MONTPELIER, OHIO — The Montpelier Telephone Company has been incorporated to maintain toll lines between villages in Williams and Fulton counties; capital, $15,000.

EAST PROVIDENCE, R. I.—The East Providence Telephone Company has been incorporated; capital, $25,000.

COLUMBUS, OHIO—The Ohio Telephone Company has been incorporated, with its principal office in this city. The capital stock is $100,000, and the incorporators are R. E. Jones, Thomas A. Simons, David C. Beggs, F. D. Simons, Capt. L. D. Myers, William C. Orr and Howard C. Parks. The corporation is formed for the purpose of building a telephone plant in this and other cities of the state.

BELMONT, N. Y.—The N. Y. & P. Telephone Company are building their line between this place and Angelica.

MONTPELIER, OHIO — Montpelier Telephone Company has been incorporated to maintain toll lines between villages in Williams and Fulton counties; capital stock, $15,000.

EAST PROVIDENCE, R. I.—East Providence Telephone Company has been incorporated, with a capital stock of $25,000.

WINCHESTER, KY.—The East Tennessee Telephone Company has been granted franchise for telephone system.

MONTGOMERY, ALA.—W. F. Vandiver, F. M. Billing and others have been granted a franchise for the establishment and maintenance of a telephone system.

HILLSVILLE, MASS. — Efforts are being made to have a telephone line put in at this place.

FREEPORT, L. I., N. Y.—The Southshore telephone line is being extended from Hempstead to Mineola.

PARK RAPIDS, MINN.—The Northern Minnesota Telephone Company has been incorporated. The intention is to construct a line between Park Rapids and Wadena, and in other parts of the state. The capital stock amounts to $10,000. Incorporators are Charles F. Mooney, F. A. Vanderpoel and Henry F. Witter, of Park Rapids; A. Boyd Kerlin, Freeport, Ill., and Cyrus Hollinger, of Lancaster, Pa.

PRESCOTT, WIS.—The Pierce County Telephone Company have completed arrangements for a St. Paul and Minneapolis connection. The metallic circuit is completed from Ellsworth to half-way between River Falls and Hudson.

HOPE, IND.—The Hope Telephone Company has been incorporated; capital, $500. Incorporators, Darius W. Dodd, Oscar W. Bowman, Joseph Burney, Thomas M. Vinnedge and Joseph A. Spaugh.

CORSICANA, TEX. — The Southwestern Telegraph and Telephone Company is expending over $50,000 in the improvements of its plant.

Electric Light and Power.

PRATT CITY, ALA.—J. M. Meighan & Company are erecting an electric light plant to cost $30,000.

WYNEE, ARK.—W. M. Kennedy may give information concerning proposed electric light plant.

MILLEDGEVILLE, GA. — H. H. Horne, Mayor, may give information concerning proposed erection of municipal electric lighting plant. A system for 50 arc and 1,000 incandescent lights is proposed.

SAVANNAH, GA. — The Edison Electric Illuminating Company, which was recently incorporated by New York and Savannah parties, is applying to the City Council for franchise to operate electric lighting plant. The company has a capital stock of $100,000.

CHESTER, PA. — The Delaware County Electric Light and Power Company has petitioned for a charter for the purpose of supplying the city of Chester with light and power.

DECATUR, ALA.—R. D. Smith is endeavoring to organize a company to construct an electric light plant.

PUEBLO, COLO.—Rocky Ford Electric Light Company has been incorporated, with a capital stock of $15,000.

MERIDEN, CT.—American Incandescent Lighting Company has been incorporated by Lyman T. Lawton, Thomas E. Webster, B. L. Lawton, A. S. Cody and Robert L. Doran; capital stock, $50,000.

FRANKLIN, KY.—B. F. Gardner, of Bowling Green, Ky., is interested in the proposed electric lighting plant for Franklin.

CLARENCE, MO.—The Mayor may be addressed concerning proposed construction of electric lighting plant.

SARCOXIE, MO. — The Sarcoxie Electric Company has been organized to build an electric light plant.

NEWAYGO, MICH.—The Newaygo Transmission Company has been incorporated, with a capital stock of $15,000; incorporators, Alliston Yerry, James F. Berry, J. E. Moore and Charles F. Peke.

WACO, TEX.—The Mutual Electric Company has been incorporated; capital stock, $10,000; corporators, W. W. Seley, S. W. Slayden, A. Goldstein and Laney Migel.

SEATTLE, WASH.—The Washington Incandescent Light Company has been incorporated.

HARPER'S FERRY, W. VA.—The Harper's Ferry Electric Light and Power Company has been incorporated, with a capital stock of $15,000.

New Incorporations.

CHICAGO, ILL.—The Gregory Electric Company has been incorporated; capital stock, $100,000; incorporators, Charles E. Gregory, George Fargher and George K. Wadsworth.

CAMDEN, N. J.—The Sawyer Manufacturing Company has been incorporated to manufacture gas fixtures, electric fixtures, etc.; capital, $50,000; incorporators, H. H. Sawyer and H. S. Sawyer, Ridley Park, Pa.; Albert Bumm, 227 Market street, Camden, N. J.; George L. Rowland, 1532 North Nineteenth street, Philadelphia, Pa.

ROCHESTER, N. Y.—The Ohmer Car Register Company has been incorporated; capital stock, $100,000; directors, John F. Ohmer, of Dayton, Ohio; Frederick Cook, Frederic P. Allen, John Harry Stedman and William B. Farnham, of this place.

Increase of Capital.

PHILADELPHIA, PA.—The Southern Electric Light and Power Company has increased its capital stock from $400,000 to $2,000,000.

LATHROPE, PA.—The Latrobe Telephone Company has increased its capital stock from $5,000 to $10,000.

INDUSTRIAL NOTES.

A new factory, the United States Carbon Company, at Cleveland, has recently been constructed and newly equipped throughout for the making of carbon specialties, particularly for electrical purposes.

F. E. Homer & Company, Cleveland, now occupy commodious shops and offices in the "Brush" Building. This company have excellent equipments for all kinds of commutator work in building, refilling and repairing.

For the convenience of their eastern customers the Washington Carbon Company, of Pittsburgh, Pa., have established branch offices at 524 Tremont Building, Boston, Mass., and 751 Bowling Green Building, New York.

The Central Electric Company, Chicago, are introducing a new type of shade-holder called the "Ideal," which is ideal in many respects, its advantages being that it is made from one piece of metal, and so constructed that it will not get out of shape, the fault of many types of shade-holders.

The new bridge just erected for the town of Bridgton, Me., has a clear span of 36 feet, a roadway 22 feet wide and a sidewalk six feet wide. It is of steel throughout, except the floor plank, having latticed girder trusses and steel beams for the floor. The Berlin Iron Bridge Company, of East Berlin, Ct., were the contractors for furnishing and erecting the bridge.

Mr. W. H. Stutchbury, manager of Edwards & Company, manufacturing electricians, with factory at 144th street and Fourth avenue, New York city, says that the year 1898 has been the most successful one in the history of the company, at least within the past five years. This company manufacture a line of standard electrical articles, such as electric bells and gongs, push-buttons and electrical articles of a similar character.

The "Hardy" incandescent lamps have quickly become one of the standard brands in electric-light fields. The makers, the K. & W. Electric Company, factory at Pittsfield, Mass., has been operated to its full capacity during the Fall months, and a representative of the ELECTRICAL REVIEW was informed that nearly the entire product was being shipped as fast as produced. This company also make dynamo brushes, arc-lamp hanger-boards, commutator compounds and several other electrical specialties.

William Roche, 259 Greenwich street, New York, the sole manufacturer of the "New Standard" dry battery, has just perfected a unique vest-pocket oval cell for light novelty work, such as electric necktie pins, etc. The battery measures on short-circuit electro-motive force 1 6 volts, and gives a current of from 10 to 12 amperes. William Roche also manufactures a special gas-engine cell, seven by three, which is also well adapted for cautery apparatus and slot-machine work. Its capacity is 1.62 volts, and from 14 to 22 amperes.

Electrical.... Patents.

(Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.)

ISSUED NOVEMBER 15, 1898.

614,076 Alternating-current motor and mode of operating same; C. S. Bradley, Avon, N. Y.—The method of converting electrical energy into mechanical motion consisting in converting a single-phase alternating current into polyphase currents, varying the rate of said currents, charging a rotary magnetic field therewith, and charging a co-operating independently movable motor element within said field with the single-phase currents.

614,082 Intermittent electric surface conductor; F. Burger, Fort Wayne, Ind.

614,124 Electric switch mechanism for electric railways; J. H. Murphy, Torrington, Ct.—Comprises an electro-magnet having a high-resistance coil in circuit through its armature lever to the contact rail and the ground or return rail, and a low-resistance coil connecting the feed-wire and the conductor rail; means for energizing the high-resistance coil to throw the armature to close the main-line or low-resistance circuit and a contact common to both the low and high resistance circuits held in continuous engagement with the armature switch in its different vibratory movements.

614,133 Switch-shifting mechanism for electric cars; J. P. Roach, Concord, N. H.

614,161 Electric-car truck; E. Cliff, Newark, N. J.

614,207 Telephone exchange system; W. E. M. Jackson, Chicago, Ill.—Consists of several transmitting devices, line circuits for each, normally open, and a receiving device common to the several transmitting devices and combined with a selective device controlling the signals from said transmitting devices.

614,225 Electric meter; L. Gutmann, Peoria, Ill.—Consists of a main coil, and a shunt-coil establishing fields in non-intersecting planes, with an endless conductor provided with perforations, a spindle for said endless conductor, a counting train adapted to engage with said spindle, and a retarding magnet reacting on said rotary conductor.

614,228 Method of charging secondary batteries; C. O. Mailloux, New York—Consists in producing progressive changes of supplemental electro-motive force acting with an electro-motive force in the circuit of said battery, and in accordance with and progressively graduated to the progress of the charge and increases of counter-electro-motive force in said battery.

614,240 Traction dynamometer; E. A. Uehling, Newark, N. J.

614,270 Insulated supporter for electric or other wires; C. K. King, Mansfield, Ohio.

614,318 Portable electric lamp; O. T. Bugg, Jr., New York, N. Y.

614,373 Arrangement for exciting magnets of dynamo machines; Max Derl, Vienna, Austria.

614,394 Starting resistance for alternating-current motors; E. L. Kahlenberger, Berlin, Germany.

614,404 Signaling apparatus; M. Martin, Malden, Mass.

TELEPHONE MANUFACTURING NOTES.

The Williams Electric Company, 80–86 Seneca street, Cleveland, Ohio, have just issued a folder illustrative of the "Williams" magneto, a telephone development which has quickly gained the indorsement of many of the best telephone experts. Some novel features are embodied in this apparatus, which make the circular important for every telephone man to receive.

The Eastern Telephone Manufacturing Company, of Meriden, Ct., has been organized to manufacture and place on the market first-class telephone instruments and apparatus at the lowest possible prices at which they can be made and sold. The principal reason why this company's apparatus can be placed at low prices is that all business will be done on a cash basis, both buying and selling. The company has no traveling representatives, and has limited the number of styles of telephones in their line of manufacture. They have all parts and sizes standardized, so that there is practically no waste or loss in manufacturing. Their product is manufactured in large quantities, which is another advantage, both to the buyer and seller.

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To the Manufacturer

The services of the Bureau will be of great value; copies and particulars of each new invention bearing particularly on their own line of manufacture will be sent them immediately as they are brought out, thus keeping them fully informed upon the latest developments in their own line of work. Should the manufacturer desire to purchase the invention, the Bureau will consummate the sale without any additional fee, further than that for its yearly services. Any inquiries will be cheerfully answered.

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Southern Electrical Supply Co.

907 Market Street.

NOTICE.

To Our Friends and Patrons:

We have moved our store from 14 South Seventh Street to a new and spacious building at 907 Market Street, where we are better prepared to take care of our customers, and shall be pleased to meet them.

We also wish to notify you that a change in the organization has taken place, and hereafter the Company will be managed by E. RUEBEL, Secretary, and CHAS. E. SHARP, Treasurer. MR. SHARP has been Manager of the Southern Electrical Supply Company for several years, and MR. RUEBEL has for many years been President of the St. Louis Electrical Supply Company, and during the past few months has been engaged in manufacturing the well known Ruebel Telephone at 917 and 919 Market Street, under the name of E. Ruebel & Co. Hereafter these telephones will be manufactured under the name of the Southern Electrical Supply Company at our new place, where one floor of the building has been set aside for this department.

We will also represent several high-grade specialties, and continue to be the exclusive agents for the products of the well known Okonite Company, and trust that the friends of the Southern Electrical Supply Company and of E. Ruebel & Co. will continue to patronize us at our new place.

Yours respectfully,

E. RUEBEL, Secretary.
CHAS. E. SHARP, Treasurer.

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Kindred.... ...Interests

The General Electric Company has established a sales office in the Templeton Building, Salt Lake City, Utah. It is in charge of Mr. H. E. Chubbuck.

The Eddy Electric Manufacturing Company, of Windsor, Ct., has opened a direct office in New York city at 143 Liberty street. Mr. H. B. Coho, widely known in electrical circles of the city, will be the manager of the New York office.

George W. Patterson, of Chicago, is issuing a special jubilee souvenir which consists of a brief history of the Spanish-American War, with atlas maps. The ELECTRICAL REVIEW acknowledges receipt of a copy, and is informed that callers at Mr. Patterson's office in the Marquette Building, Chicago, can secure a copy of the souvenir.

De Veau & Company, telephone manufacturers, Rose street, New York city, are one of the busiest houses in this branch of the industry. Among recent orders were 200 complete sets for the new Syndicate Building at 13-21 Park row; 100 sets for a new hotel in Los Angeles, Cal., and 200 sets in a large apartment house in upper New York city. An order for nearly 1,000 special transmitters was also among the recent ones received. The product of this company has always ranked among the best, and practical telephone men are connected with every department.

The closing days of the Mechanics Fair, at Boston, with its multitude of interesting and instructive exhibits, are drawing near, and but three weeks now remain in which to take advantage of what is literally "a two-dollar show for a quarter," as one delighted visitor has characterized it. There are over 350 individual exhibits, the mammoth building being filled to overflowing with so many novelties and attractions that a whole day can be spent without seeing all. Many of the exhibits, it is safe to say, will never again be gotten together under one roof, and those who fail to visit the fair will miss the opportunity of a life time. The exhibition will positively close December 3.

The Montauk Multiphase Cable Company, 100 Broadway, New York city, are making an exhibit of their interior thermo static electric fire-alarm cables at the Massachusetts Charitable Mechanics' Association Fair, now being held in Boston. Mr. Lucian W. Jenney, who was in charge of this company's exhibit in the Electrical Show in Madison Square Garden, New York city, last May, is the supervisor of the exhibit at Boston. *The Scientific Australian,* published at Melbourne and Sydney, Australia, in a recent issue, describes a test of the Montauk cable recently made at the head station of the Metropolitan Fire Brigade, Melbourne. The experiments were entirely successful, and demonstrated the value of this cable as an auxiliary fire-alarm. At the recent meeting of the International Association of Fire Engineers, held in St. Louis, the cable was shown to the members at the suggestion of Chief Bosch, superintendent of the fire-alarm telegraph system of Newark, N. J.

The great shops of the Edward P. Allis Company, at Milwaukee, are unusually active, and the number of large engine installations in prospect is greater than for many years. The company are now perfecting the following equipments among others for electrical work: For the underground road in London three 1,300-horse-power compound engines have been shipped, and three more are nearly ready for shipment; three compound engines were shipped to Sheffield, Eng., during the last week in October; six vertical engines are now being forwarded to Dublin, Ireland; three compound engines have just been installed at Middleborough, Eng. Among the American orders recently executed are the following: Four compound vertical engines for the Cincinnati Edison Company, and a fifth has just been asked for. These engines are of 1,200-horse-power economical rating. It is said that the new Cincinnati station is to be the most complete lighting plant in America. Four engines are now being installed for the Milwaukee Electric Railway Company. Eight engines are being built for the Metropolitan Street Railway Company, of New York, which, it is said, will be the largest stationary engines ever constructed. They will develop 4,500 horse power under economical conditions and 7,000 horse-power may be developed under maximum conditions. Two additional engines, of the compound type, are being built for the West Side "L," of Chicago. Four engines for the Kings County Electric Light Company, of Brooklyn, have recently been finished. A single engine for light and power for the A. & P. Roberts Company, of Philadelphia, and an additional 1,400-horse-power engine for the Carnegie Steel Works, at Pittsburgh. These are only a small portion of the orders for large engines this company now have in hand, but they are sufficient to show the increased demand for this class of machinery.

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